U.S. Department of the Interior
Bureau of Land Management

Medford District Office
Ashland Resource Area
3040 Biddle Road
Medford, Oregon 97504

August 1995

Middle Applegate Watershed Analysis

Version 1.3

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

BLM/OR/WA/PL-95/035+1792

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Introduction

Watershed analysis is the primary tool for generating information to implement ecosystem management as directed in the Northwest Forest Plan and the Medford District Resource Management Plan. The Middle Applegate Watershed Analysis documents conditions and interrelationships of ecosystem components for the Middle Applegate Watershed. The analysis focuses on issues and key questions that are most relevant to the management questions, human values, or resource conditions within the watershed. Management objectives and recommendations are prioritized based on conclusions reached through the analysis. The watershed analysis formulates an overall landscape design and recognizes the inventory, monitoring, and research needs for the watershed.

The Middle Applegate Watershed Analysis was prepared by an interdisciplinary team of resource professionals and specialists from the Ashland Resource Area and Medford District Staff. The watershed analysis team followed the six step process outlined in the *Draft Revised Federal Guide for Watershed Analysis, version 2.1.* The six steps, or sections, included in the Middle Applegate Watershed Analysis are watershed characterization, issues and key questions, prehistorical and historical conditions, current conditions, interpretation, and management objectives and recommendations. The team separated ecosystem elements into human dimension, terrestrial, and aquatic domains. These domains identify and focus on manageable subsets of ecosystem elements while recognizing their interrelationships.

The Middle Applegate Watershed Analysis is based on existing information and addresses the entire watershed. Much of the information found in this watershed analysis comes from documents prepared for the Applegate River Subbasin. Where resource information is missing, a data gap is identified. The watershed analysis process is iterative and new information will be used to supplement future iterations of the analysis.

Public participation for the Middle Applegate Watershed Analysis built upon previous public involvement efforts. Personal contact was made with many of the local interest groups and an Open House was held at the Applegate School to share the team's preliminary issues and key questions and to solicit thoughts and ideas for the watershed analysis. In addition, a mailer was sent to local residents, local and regional interest groups, and to most local, state, and federal agencies in Jackson and Josephine counties. The mailer provided an opportunity to return written comments.

Watershed Characterization

The Middle Applegate Watershed is a 131 square mile (83,585 acres) watershed within the Applegate River Subbasin. The Applegate is one of seven subbasins within the Rogue River Basin in southwest Oregon. The Middle Applegate Watershed lies within the Klamath

Mountains Geologic Province and extends from the mouth of Williams Creek near the Josephine-Jackson county line to the confluence of the Little Applegate River. It is comprised of five subwatersheds: Ferris/Slagle, Thompson Creek, Humbug/Chapman, Forest Creek, and Spencer/Rock.

Land ownership within the Middle Applegate is divided between the Bureau of Land Management (47,292 acres), U.S. Forest Service (2,077 acres), State of Oregon (203 acres), and private (34,013 acres). Federal land use allocations include Riparian Reserves, Late-Successional Reserves, and the Applegate Adaptive Management Area.

The terrain within the Middle Applegate consists of steep hillsides and narrow, flat valley bottoms. Overall, soils within the watershed are stable and erosion rates are relatively low. However, there are some erosion-prone, steep, gravel-surfaced slopes and granitic areas.

The Applegate Valley is one of the driest and warmest areas west of the Cascade Mountains. The Middle Applegate Watershed is characterized by historically high fire frequencies (10 to 30 year return interval).

Endemic vegetation in the Middle Applegate Watershed is a result of climate fluctuations and the unique geology of the area. Plant series identified for BLM-administered lands within the watershed include Douglas-fir, ponderosa pine, and white oak. There are six special status vascular plants known to occur within the watershed and a potential for 55 nonvascular plants.

The watershed also contains habitat for the Siskiyou Mountains salamander and Critical Habitat for the northern spotted owl. The Middle Applegate Watershed provides spawning and rearing habitat to several anadromous and resident fish species, including coho salmon and steelhead.

Issues, Key Questions, Analysis Findings, and Management Objectives

Issue: *Human Dimension*

Key Questions and Analysis Findings
Key Question 1. *How have human activities affected land management?*
Expanding rural interface areas have substantially influenced the management of adjacent forests. Efforts to use fire as a management tool have been constrained by the need to protect private property and public health. Use of logging roads for access to private property and for hauling logs creates safety and maintenance concerns. Timber trespass and other unauthorized uses of public lands frequently occur in rural interface areas and have increased administrative costs. Conflicts between land development and livestock grazing have resulted in a reduction of land managed for grazing. Available wildlife habitat has also been reduced due to residential development intruding into previously forested areas.

Key Questions and Analysis Findings
Key Question 2. ***How do human activities affect natural processes?***
Historically, high fire frequencies have been a natural process in the Middle Applegate Watershed. Fire suppression has eliminated frequent fire occurrence from the ecosystem. This has altered forest stand development and ecosystem disturbance processes. Logging and road construction have accelerated soil erosion leading to reduced site productivity. Mining, logging, road construction, dam and levee construction, water diversions, grazing and agricultural development have affected many natural processes in the aquatic ecosystem. Effects include disruption of subsurface flow and reduced stream shading, nutrient cycling, energy dissipation, sediment storage, summer streamflows, and floodplain maintenance and development.
Key Question 3. ***What are the current uses and how are they changing?***
Current uses in the Middle Applegate include mining, agriculture and forest commodity production, residential, dispersed recreation, wildlife, and fish. Mining activity has greatly diminished since historic levels and now primarily consists of small placer operations using suction dredges. Agriculture and forest commodity production is declining. Many large farms and ranches have been subdivided into small "hobby farms" and woodlots. Timber harvest is decreasing on public lands and has recently increased on private lands. Residential development is continuing. Dispersed recreation use is increasing as the local human population increases. Wildlife and fish use is declining due to habitat loss and deteriorating habitat conditions.

Management Objectives Addressing the Human Dimension Issue
Continue to coordinate with individuals, companies, county, state, and other federal agencies on all inquiries/applications for mineral exploration and development on BLM-managed lands.
Rehabilitate areas disturbed due to past mining claim activity. On disturbed sites, ensure public safety and enhance other resource values on disturbed sites such as riparian habitat or fisheries production.
Manage livestock in a manner which maintains or improves Riparian Reserves in order to meet the goals of the Aquatic Conservation Strategy.
Continue to provide livestock forage on designated allotments to meet societal needs, without compromising the ecological integrity of the uplands.
Resolve unauthorized use complaints.
Manage a transportation system that serves the needs of the users and meets the needs identified under other resource programs.
Maintain a transportation system that meets the Aquatic Conservation Strategy and Riparian Reserve objectives.
Cooperate with individuals, companies, Jackson and Josephine counties, the state, and other federal agencies to achieve consistency in road location, design, use, and maintenance.
Continue to coordinate with individuals, companies, non-profit groups, counties, state, and other federal agencies on all inquiries/applications for non-road rights-of-way, leases, permits, and exchanges on BLM managed lands.
Minimize and/or reduce unauthorized use on BLM-administered lands.

Management Objectives Addressing the Human Dimension Issue
Work with OHV groups to jointly remedy problems, assist in project planning, and develop opportunities to prevent future problems.
Maintain and develop opportunities for special forest products to facilitate community economic development consistent with other resource objectives.
Maintain contacts with local groups, adjacent landowners, community leaders, tribal and public agencies to facilitate continuing dialogue on the management of public lands in the Middle Applegate Watershed.
Assess archaeological sites to determine their scientific and heritage value and protect or recover those values as necessary.

Issue: *Maintenance of Natural Processes and Functions*

Key Questions and Analysis Findings
Key Question 1. *Are the "natural" functions and processes working?*
"Natural" functions and processes are working in the Middle Applegate Watershed. However, some functions and processes have been altered by human activities such as fire suppression, mining, logging, road construction, dam and levee construction, water diversions, grazing, and agricultural development. Alterations to "natural" functions and processes in the terrestrial ecosystem include accelerated soil erosion, reduction in site productivity, lower fire frequency, altered forest stand development, and increased levels of insect populations. In the aquatic ecosystem, alterations to "natural" functions and processes include disruption of subsurface flow and reduced stream shading, nutrient cycling, energy dissipation, sediment storage, summer streamflows, and floodplain maintenance and development.
Key Question 2. *How healthy is the ecosystem in the Middle Applegate Watershed?*
The forest ecosystem is not healthy in regards to its resiliency to drought, wildfire, and insect attack. Plant competition (indicated by high tree stocking levels) and expanding bark beetle populations are causing vegetation mortality and increasing the potential for a catastrophic stand-replacement fire. Vegetation species composition and stand structure shifts could also be considered unhealthy. Ponderosa pine, a drought resistant species, is declining in abundance.

Management Objectives Addressing the Maintenance of Natural Processes and Functions Issue
Maintain and enhance site productivity within natural ecological levels wherever operationally possible.
Increase quality and vigor of individual trees.
Enhance and restore fire and drought resistant trees.
Develop a diverse landscape pattern and contiguous areas of multi-layered, late-successional forest. Manage for mature/old-growth condition class in 15 percent or more of the BLM forest lands within the watershed.
Reduce fire hazard of timber stands by decreasing the ladder fuels.
Retain at least 15 percent of federal land in the watershed as untreated area.

Management Objectives Addressing the Maintenance of Natural Processes and Functions Issue
Maintain or improve the natural functions and processes of the native grass/oak woodlands plant associations.
Maintain or enhance in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. Protect the timing, magnitude, duration, and spatial distribution of peak, high, and low flows.
Maintain or enhance riparian vegetation to promote species and structural plant community diversity, shading, and coarse woody debris.

Issue: *Need for Vegetation Management*

Key Questions and Analysis Findings
Key Question 1. *Are plant species adapted to the environment in which they are found?*
All plant species in the watershed appear to be adapted to the Klamath Geologic Province. Ponderosa pine is especially well-suited to the Middle Applegate Watershed because of its drought resistance characteristics. Douglas-fir is also adapted to the drought conditions in the watershed. Native herbaceous plant species and natural plant communities are well-adapted to this area. However, non-native plant species are often able to outcompete natives if the organisms and processes that limit their distribution and reproduction do not exist at the introduced site.
Key Question 2. *Are forests growing at an acceptable rate?*
Overall, forests in the Middle Applegate are not growing at an acceptable rate, nor are they presently on a trajectory for attainment in the foreseeable future. Acceptable forest growth is attained when forests grow at a rate that satisfies the desired structural and production characteristics for the specific resource management objectives of the stand. Observations and data indicate that the forests are predominately lacking resiliency and vigor. A diminished ability to resist potentially damaging forest insects, particularly bark beetles, is characteristic of forests lacking vigor. The ongoing escalation of bark beetle related tree mortality throughout the Middle Applegate is consistent with this premise. The primary factor contributing to diminished forest vigor is elevated forest density, resulting in excessive competition for resources including water, light, and nutrients.

Management Objectives Addressing the Need for Vegetation Management Issue
Enhance and restore drought resistant trees such as pine species and incense cedar by stand cultural work and by creating conditions favorable for regeneration.
Maintain existing areas of knobcone pine to protect the ecological functions of the associated vegetation species.
Increase tree growth, quality, and vigor of individual trees using density management techniques.

Issue: *Fire Risk and Fire Hazard*

Key Questions and Analysis Findings
Key Question 1. ***What is the risk or hazard to life, property, or of catastrophic loss?***
The risk or hazard to life, property, or of catastrophic loss is moderate on the main valley bottom and high on the uplands.
Key Question 2. ***What are the long-term ecological changes due to fire or lack of fire?***
Lack of fire in the forest ecosystem has resulted in changes in forest structure, composition, and density. Forest stands seem to be more homogeneous than in the past and vegetation density levels are much higher. Conifer stands have reached the point of suppression and mortality. Old-growth trees will continue to die if density levels are not reduced. Shade intolerant species such as pine species and incense cedar will continue to decrease in forest stand species composition. Other vegetation condition classes will also continue to lose their integrity. Fire suppression has removed the majority of low to moderate severity fire events, and has allowed heavy fuel accumulations in forest stands. The probability of a major, stand-replacement fire increases yearly. Air quality has improved significantly with fire suppression and smoke management.
Key Question 3. ***Where are the high fire risk areas?***
High fire risk areas include major ridges, lands adjacent to roads, powerlines, and private lands. Lightning strikes on ridges, ignition of dry grass by off-highway and other vehicles, and sparks from damaged powerlines can cause fire starts.
Key Question 4. ***Where are the high fire hazard areas?***
High fire hazard areas are in the upland areas where the fuel loadings are moderate to high and the slopes range from moderate to steep. Canyons are particularly sensitive because they act like chimneys during wildfire events.

Management Objectives Addressing the Fire Risk and Fire Hazard Issue
Reduce the risk of loss from and the occurrence of catastrophic wildfire while meeting the needs identified under other resource programs.
Lower the high hazard areas (where possible) to a medium hazard while meeting the needs identified under other resource programs.
Lower the medium hazard areas (where possible) to a low hazard while meeting the needs identified under other resource programs.
Reduce the human ignition sources causing wildfire.
Enhance and restore fire resistant trees.
Maintain and enhance air quality.

Issue: *Special Status Species (Plant and Animal)*

Key Questions and Analysis Findings

Key Question 1. ***What special status species exist in the watershed?***

Six species of special status vascular plants exist in the watershed: *Cypripedium fasciculatum Cypripedium montanum, Fritillaria gentneri, Mimulus douglasii, Sedum laxum ssp. heckneri*, and *Sedum oblanceolatum.*

Twenty three special status wildlife species are known or suspected to be present in the Middle Applegate, including the northern spotted owl and bald eagle which are listed as threatened under the Endangered Species Act.

Key Question 2. ***What are the habitat conditions for special status species?***

Habitat conditions for special status plant species are threatened by human-caused disturbances. Valley bottom plant communities are being eradicated in favor of agricultural and ranch land, homesites, and roads. Low-middle elevation grasslands/savannahs are threatened by invasion and dominance of non-native plant species.

Overall, wildlife habitat condition is in decline which affects special status species. Habitat provided by the grass/forbs/herbaceous condition class is declining due to noxious grass/forb invasion. The shrubland habitat is declining due to lack of early seral stages. The hardwood/woodland habitat is declining due to overdense conditions and loss to development. Early and seedling/sapling and pole habitat are declining due to lack of snags and potential loss of large patches in the long-term. Mid habitat is declining due to a high frequency of overdense, single canopy stands. The mature/old-growth habitat is declining due to removal during timber harvest.

Key Question 3. ***What are the conditions of the terrestrial ecosystem, and how do conditions of the terrestrial ecosystem in the watershed influence ecological diversity and maintenance of processes?***

Human actions have directly and indirectly caused vegetation composition and structure changes resulting in plant communities which are overly dense, more homogeneous than previously, or dominated by non-native (and sometimes noxious) species. Biodiversity and ecosystem health in the Middle Applegate have declined since Euro-American settlement.

Terrestrial ecosystems support approximately 230 wildlife species in the watershed. Even though the quality of most wildlife habitats is declining, species richness is subjectively rated as high due to the array of habitat types found in the watershed. Forested "stringers" help in dispersal, but the bottomland environment can impede or block dispersal of less mobile species.

Management Objectives Addressing the Special Status Species Issue

Preserve, protect, or restore species composition and ecological processes of natural plant communities.

Conserve and enhance rare and special habitats, endemic plant communities, and ecosystems.

Avoid management actions that will contribute to the need to list any species as Threatened or Endangered by either the state or federal agencies.

Monitor population trends of special status wildlife species.

Management Objectives Addressing the Special Status Species Issue
Develop and maintain an adequate abundance and distribution of all vegetation condition classes.
Improve habitat condition in all vegetation condition classes.
Protect dispersal corridors.

Issue: *Water Quantity and Quality*

Key Questions and Analysis Findings
Key Question 1. ***What are the water quantity and quality concerns?***
The most notable water quantity concern is low summer streamflows. Water quality problems include elevated summer stream temperatures, turbidity/sedimentation, low dissolved oxygen, excess nutrients, low flows, and insufficient stream structure.
Key Question 2. ***What has been the role of natural and management related disturbance in creating historic and current water quantity and quality concerns?***
Extended periods of below normal precipitation in the past and present have contributed to extremely low summer streamflows. Historic and current surface and ground water withdrawals have further contributed to low summer streamflows. Today's dense upland vegetation likely has higher transpiration rates than historic vegetation levels. More water being used by upland vegetation implies less water is available to supply streams and recharge ground water. Natural disturbances such as wildfire and flooding have had temporary detrimental effects on water quality. Management disturbances that created historic and current water quality concerns include mining activities (especially large scale hydraulic mining), agricultural development (i.e. clearing streamside vegetation, livestock grazing, and irrigation), logging activities (i.e. road building, yarding, and vegetation removal), residential development (i.e. road building and land clearing), and off-highway vehicle use (particularly trails that run perpendicular to the contour).

Key Questions and Analysis Findings
Key Question 3. ***Where are sensitive areas (related to hillslope, hydrologic, and riparian vegetation) located within the watershed and what is the nature of the sensitivity?***
Sensitive areas related to hillslope erosion hazard include steep, gravel surfaced slopes and steep granitic soils. Potential problem areas are Timber Mountain, Tallowbox Mountain, and the upper portions of Forest Creek. Areas of high road density, stream crossing density, and/or soil compaction are the most sensitive with regards to disruption of hydrologic processes. Highest road densities are found in Forest Creek and Spencer/Rock subwatersheds. Stream crossing density is highest in Forest Creek and Humbug/Chapman subwatersheds. Small areas of highly compacted soil are located in Rock Gulch, Ferris Gulch, and the headwaters of Thompson Creek. Erosion from extensive off-highway vehicle use is of particular concern in Ferris Gulch, Hinkle Gulch, China Gulch, Forest Creek, and upper Poorman Creek. Stream reaches that appear to be unstable due to past hydraulic mining include the lower reach of Ferris Gulch, lower reach of Slagle Creek, Humbug Creek (between Left Fork and Kane Creek), and Forest Creek (between Bishop Creek and the Right Fork). Lack of stream shading due to insufficient riparian vegetation along some stream reaches contributes to elevated summer stream temperatures. The reduction in large conifers along many stream reaches caused by logging, mining, agricultural, and residential activities has resulted in insufficient stream structure.

Management Objectives Addressing the Water Quantity and Quality Issue
Maintain and enhance in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. Protect the timing, magnitude, duration, and spatial distribution of peak, high, and low flows.
Maintain and enhance water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Reducing summer stream temperatures and sedimentation are two principal water quality objectives in the Middle Applegate Watershed.

Issue: *Riparian Areas*

Key Questions and Analysis Findings
Key Question 1. ***What was the prehistoric condition of riparian habitat within the watershed, and how was this habitat influenced by hillslope processes, hydrology, vegetation, and stream channel conditions?***
Prior to the arrival of Europeans, riparian habitat along the Applegate River contained a diversity of plant species and age classes, and the streams were dynamic, with ample coarse woody debris and good water quality. Lowland floodplains were constantly changing with periodic flooding, and had multiple channels where sediment and coarse woody material were deposited. Beaver were plentiful throughout the watershed and their dams contributed to sediment storage and reduced water velocities. The upland areas were a matrix of forests and meadows. Sediment and woody material contributed to natural functions and processes and were introduced into streams at natural rates.

Key Questions and Analysis Findings
Key Question 2. ***What are the current conditions of riparian habitat, and how is habitat being influenced by hillslope processes, hydrology, vegetation, and stream channel conditions?***
Today, many lowland areas lack natural floodplains. Riparian vegetation is often only a narrow strip and lacks the variety of plant species and age classes that once existed. Himalayan blackberries have invaded most lowland riparian zones. Coarse woody debris is lacking in most streams. Also lacking in many areas is the potential replacement of coarse woody debris. Clearcut or overstory removal timber harvest and a proliferation of roads have interrupted the natural flow of sediment, woody material, and nutrients to the streams. These factors are often responsible for unnaturally high levels of sediment and turbidity in streams.
Key Question 3. ***What has been the role of natural and management related disturbance in creating historic and current habitat conditions?***
Wildfires, wind storms and periodic flooding were the major natural disturbances that influenced riparian habitat prior to 1820. These events accelerated movement of soil and woody material for relatively short periods of time. With the coming of Europeans, beaver populations were reduced to low levels. Mining, livestock grazing, and logging in both riparian and upland areas drastically altered riparian habitats and vegetation composition in the uplands, and degraded water quantity and quality. Agricultural development and road construction resulted in channelized streams and narrowed floodplains.
Key Question 4. ***Where are sensitive riparian areas located within the watershed and what is the nature of the sensitivity?***
The most sensitive riparian areas are located in the valley bottoms. Urban development and agriculture have reduced, and in some cases eliminated riparian vegetation along the Applegate River and along the lower reaches of Slagle, Thompson, Humbug, and Forest creeks. Stream courses have been straightened and floodplains have been compromised by development and regulated streamflow from Applegate Dam. Natural processes and functions have been simplified. While not as sensitive as the lower reaches, riparian areas located in the upper stream reaches of the Middle Applegate are a concern because they are not able to contribute a sufficient volume of coarse woody debris. Fire suppression and riparian logging have created riparian zones dominated by dense stands of younger age conifers or hardwoods and shrubs that are lacking in large overstory structure.

Management Objectives Addressing the Riparian Issue
Maintain and enhance the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration, and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability. Maintain and enhance riparian habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Issue: *Fish*

Key Questions and Analysis Findings
Key Question 1. *What was the prehistoric condition of stream habitat within the watershed, and how was this habitat influenced by hillslope processes, hydrology, vegetation, and stream channel conditions?*
Prehistoric stream habitat conditions in the Middle Applegate Watershed were conducive to supporting fish populations that were considerably larger than they are at present. Adequate quantities of spawning gravel for anadromous and resident fish were available in the Applegate River and its tributaries. Pool-to-riffle ratios and pool areas and depths were also adequate to the needs of the various fish species. Properly functioning riparian and hillslope processes ensured good water quality and quantity and an ample food supply.
Key Question 2. *What are the current conditions of stream habitat, and how is habitat being influenced by hillslope processes, hydrology, vegetation, and stream channel conditions?*
Stream habitat conditions in the Middle Applegate are not as favorable to fish and macroinvertebrates as they were in the past. Habitat complexity is greatly simplified compared to prehistoric conditions. Stream structure provided by coarse woody debris is lacking. Canopy cover does not provide adequate shading and consequently summer stream temperatures are elevated. Water withdrawals result in drastically reduced summer streamflows. Low pool-to-riffle ratios and high channel width-to-depth ratios do not provide adequate aquatic habitat. Size composition of substrate material often lacks the diversity needed to meet fish and macroinvertebrate requirements. Substrate embeddedness exists on some of the flatter gradient stream reaches.
Key Question 3. *What has been the role of natural and management related disturbance in creating historic and current habitat conditions? What are the outside influences on aquatic resources? (i.e. Applegate Dam)*
The decline in fish habitat in the Middle Applegate Watershed may have started with the reduction of the beaver population in the early 1800's. Stream habitat degradation increased following the onset of placer mining, livestock grazing, agricultural development, water diversions, logging, road construction, and channelizing. These activities disrupted floodplains, reduced riparian habitat, degraded water quality, and altered streamflow patterns. The combined effect of these impacts on the stream environment resulted in loss of spawning and rearing habitat and subsequent decline in fish production. Regulated flows from Applegate Dam have improved spawning and rearing conditions in the Applegate River, and fall chinook and winter steelhead are showing marked increases in their populations. Anadromous fish are subject to other conditions outside the watershed including ocean rearing conditions, ocean sport and commercial fisheries, and river sport fisheries.

Key Questions and Analysis Findings

Key Question 4. ***Where are sensitive areas for fish located within the watershed and what is the nature of the sensitivity?***

The lowland portions of the Applegate River and the major tributary streams are the primary areas for anadromous fish spawning and rearing. These are also the most sensitive areas from a standpoint of simplified natural functions and processes in floodplain and riparian habitats. Tributary streams lack adequate water quantity and quality for good steelhead and resident trout production. Floodplains and channel morphology have been altered on the Applegate River and its tributaries. Riparian habitat lacks diversity in plant species and size.

Key Question 5. ***What is the general health of fish and other aquatic resources?***

Fish populations are drastically reduced from prehistoric levels because of habitat alteration and impaired water conditions. The majority of anadromous fish spawn and rear in the lower stream reaches of the watershed, which are the most degraded. Coho are nearly non-existent in the Applegate system and floodplain alterations will continue to limit suitable rearing habitat. Fall chinook and to a lesser extent, winter steelhead are benefitting from regulated streamflows from Applegate Dam and are showing marked improvement. Summer steelhead depend on the smaller tributaries for their spawning habitat and continue to be impacted by watershed alterations, poor riparian and stream habitat conditions, and water withdrawal. Some resident trout habitat in headwater streams is in fair to good condition, but resident fish numbers are depressed due to degraded habitat conditions.

Management Objectives Addressing the Fish Issue

Manage habitat for all species of anadromous, resident trout, and native non-game fish on BLM-administered lands.

INTRODUCTION

The Middle Applegate Watershed Analysis documents conditions and interrelationships of ecosystem components for the Middle Applegate Watershed. It describes the dominant features and physical, biological, and social processes within the watershed. The document compares prehistorical, historical, and current ecosystem conditions and discusses the causes of these conditions and future trends. Prioritized management objectives and recommendations directed development of an overall landscape design. This document is intended to guide subsequent project planning and decision making in the Middle Applegate. Site-specific analysis incorporating the NEPA process would occur prior to any project implementation. Research and monitoring needs are also included in the watershed analysis.

The Middle Applegate Watershed Analysis was prepared by an interdisciplinary team of resource professionals and specialists from the Ashland Resource Area and Medford District Staff (see List of Preparers). Group discussions identified linkages between resources and resulted in an integrated, synthesized report.

Technical reports were written for most of the ecosystem components addressed in this document. The individual reports provide greater detail and include technical discussions. They were omitted from the watershed analysis to ensure readability by the lay person and to prevent the document from becoming too lengthy. The technical reports are listed in the back of the document and are available at the Medford District Office, Ashland Resource Area.

Maps are grouped together and placed at the end of the document. All maps in the watershed analysis were generated using Medford District geographic information systems (GIS).

Guidelines used to direct the preparation of the Middle Applegate Watershed Analysis included: the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (USDA and USDI 1994a), *Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (USDA and USDI 1994a), the BLM/Forest Service *FY 1994-96 Watershed Analysis Guidelines* (USDA AND USDI 1994b), the six steps from the draft *Revised Federal Guide for Watershed Analysis, version 2.1* (Regional Ecosystem Office 1995), and the *Medford District Watershed Analysis Guidelines* (USDI 1994).

The Middle Applegate Watershed Analysis is based on existing information and addresses the entire watershed. Much of the information found in this watershed analysis came from documents prepared for the Applegate River Subbasin: *Applegate Adaptive Management Area Ecosystem Health Assessment* (USDA and USDI 1994c); *Applegate River Watershed Assessment: Aquatic, Wildlife, and Special Plant Habitat* (USDA AND USDI 1995a); *Words into Action: A Community Assessment of the Applegate Valley* (Preister 1994); and *Applegate Watershed Assessment* (Applegate River Watershed Council 1994). Prehistorical and historical information was obtained primarily from *An Environmental History of the Little Applegate River Watershed* (LaLande 1995).

Where resource information is missing, a data gap is identified. Data gaps are prioritized and listed in a separate section of the watershed analysis. Missing information will be acquired as funding permits. The analysis process is iterative and new information will be used to update the watershed analysis.

Public participation for the Middle Applegate Watershed Analysis built upon analysis and public involvement efforts that already occurred in the Applegate. Issues, concerns, and watershed conditions developed in previously prepared documents for the Applegate River Subbasin were used as a basis for developing the issues and concerns for the Middle Applegate Analysis.

During the early stages of the watershed analysis, personal contact was made with many of the local interest groups. The groups were asked to identify their issues and concerns, and contribute any other thoughts and ideas for the watershed analysis. Groups included in this initial contact were: Applegate Partnership, Applegate Watershed Conservancy, Headwaters, North Applegate Watershed Protection Association, Off-Highway Vehicle group, Sierra Club, Southern Oregon Timber Industry Association, and Thompson Residents for Ecological Education.

The watershed analysis team also hosted an Open House at the Applegate School on March 28, 1995. Preliminary issues and key questions were displayed at the Open House and additional issues, concerns, thoughts, or ideas were solicited from those attending. The Open House was advertised in flyers placed at key locations in Ruch and Applegate, and in a mass mailing to local residents, local and regional interest groups, and to most local, state, and federal agencies in Jackson and Josephine counties. The mailer also provided an opportunity to return written comments, if people were interested but unable to attend the Open House. Five people attended the Open House and no new issues or ideas were received. No written comments were received in response to the mailer.

The organization of this document follows a slightly modified format of the six step process described in the draft *Revised Federal Guide for Watershed Analysis, version 2.1* (Regional Ecosystem Office 1995). The Watershed Characterization section places the Middle Applegate Watershed in context within the Applegate River Subbasin and Rogue River Basin. It describes the distinguishing physical, biological, and human dimension features of the watershed. The Issues and Key Questions section provides a focus for the analysis on the key ecosystem elements that are most relevant to the management questions, human values, or resource conditions within the watershed. The Prehistorical and Historical Conditions section describes how human influences and natural disturbances have affected current conditions in the Middle Applegate. The Current Condition section details current conditions of the physical, biological, and human ecosystem elements. The Interpretation section compares the prehistorical and historical conditions with the current conditions, explains differences, and describes trends. The Management Objectives and Recommendations section identifies management objectives for the Middle Applegate Watershed and prioritizes management activities to achieve the objectives. The Landscape Analysis and Design section synthesizes resource data to create landscape pattern objectives and recommendations. Prioritized research and monitoring needs are included in a separate section with identified data gaps.

Most sections in this watershed analysis are separated into three domains: human dimension, terrestrial, and aquatic. These domains are subsets of the ecosystem elements. This organizational technique was used to assist the analysis team in assessing the complex set of issues, system components, resources, and processes present in the Middle Applegate Watershed. Utilizing the three domains allowed the team to identify and focus on manageable subsets of watershed ecosystems while recognizing their relationships with other subsets.

WATERSHED CHARACTERIZATION

The Middle Applegate Watershed is a 131 square mile (83,585 acres) watershed within the Applegate River Subbasin (Map 1). The Applegate is one of seven subbasins within the Rogue River Basin in southwest Oregon (OWRD 1989). The Applegate area is designated as an Adaptive Management Area (AMA) in the Northwest Forest Plan Record of Decision (ROD) (USDA and USDI 1994a). A detailed characterization at the subbasin scale may be found in the *Applegate Adaptive Management Area: Ecosystem Health Assessment* (USDA and USDI 1994c).

The Middle Applegate Watershed extends from the mouth of Williams Creek near the Josephine-Jackson county line to the confluence of the Little Applegate River. It is comprised of five subwatersheds: Ferris/Slagle, Thompson Creek, Humbug/Chapman, Forest Creek, and Spencer/Rock (Map 10). The primary community centers are Applegate and Ruch. The latter is also a social confluence for Upper Applegate residents. Oregon State Highway 238, which connects Jacksonville and Provolt, is a major transportation corridor through the Middle Applegate Watershed.

Land ownership is a mix of public and private (Table 1). The ownership pattern mirrors that which is found throughout much of the western United States, the fertile bottom lands being primarily private and the associated uplands largely public (Map 2). Because the majority of fish-bearing streams within the Middle Applegate are located in the valley bottoms, the Bureau of Land Management (BLM) manages less than 20 percent of the fish-bearing stream miles within the watershed. A significant amount of private rural interface (11,000 acres) is present within the analysis area (USDI 1994). Rural interface areas are areas where rural residential and/or farm/forest zoning occur within 1/2-mile of adjoining BLM-administered land. There are no large industrial holdings.

Table 1. Land Ownership in the Middle Applegate Watershed

Ownership	Acres	Percent
Bureau of Land Management (BLM)		
O&C	41,094	49.2
Public Domain	6,048	7.2
Reserved Mineral	150	0.2
Total BLM	47,292	56.6
U.S. Forest Service	2,077	2.5
State	203	0.2
Private	34,013	40.7
Total	83,585	100.0

Source: Medford BLM Geographical Information System (GIS)

The Northwest Forest Plan designates three land use allocations for federal lands in the Middle Applegate Watershed: Riparian Reserves, Late-Successional Reserves (LSR), and the Applegate Adaptive Management Area (AMA). Table 2 shows acres by land use allocation. Riparian Reserve acres are included in the LSR and AMA totals. Actual Riparian Reserve acres have not been determined. They are dependent on two factors that need to be identified on-the-ground: stream category and site potential tree height. LSR and AMA land use allocations are displayed on Map 3.

Table 2. Federal Land Use Allocations in the Middle Applegate Watershed

Federal Land Use Allocations	Acres
Applegate Adaptive Management Area	49,104
Late-Successional Reserves	265
Total	49,369
Riparian Reserves (within AMA and LSR)	Unknown

Source: Medford BLM GIS

The terrain within the Middle Applegate Watershed includes steep hillsides and narrow, flat valley bottoms. One of the most striking landscape characteristics is the vegetative contrast between the southerly/westerly and the northerly/easterly aspects. These factors combined with an extremely variable climate have resulted in a diverse flora, which has a significant impact on wildlife distribution.

Overall, soils within the watershed are stable and erosion rates are relatively low. However, some steep, gravel-surfaced slopes and granitic areas are present. Potential problem areas include Timber Mountain, Tallowbox Mountain, and the upper portions of Forest Creek.

Plant series identified for BLM-administered lands within the watershed include Douglas-fir, ponderosa pine, and white oak (Atzet and Wheeler 1984). Fire suppression since the turn of the century has encouraged the encroachment of Douglas-fir into areas historically dominated by pines and oaks. Stand vigor is also declining due to overstocking. Insect damage and disease are prevalent. As a result, the potential for a large catastrophic fire increases annually.

Native herbaceous vegetation is also on the decline due in part to a serious noxious weed problem throughout the watershed. Other factors contributing to the decline include introduction of non-native plant species and years of fire suppression that have caused vegetation composition, structure, and stocking level changes. There are six special status vascular plants known to occur within the watershed and a potential for 55 nonvascular plants. The watershed also contains habitat for the Siskiyou Mountains salamander and Critical Habitat for the northern spotted owl.

The Middle Applegate Watershed provides spawning and rearing habitat to several anadromous and resident fish species (Maps 14, 15, 16, and 17). Regulated flows from the Applegate Dam have benefitted fish within the Applegate River, but the resultant reduction in magnitude and frequency of flooding have altered natural channel processes.

Historic human activities within the watershed include mining, grazing and logging. Although these uses have dramatically declined, they are still important to many individuals and could potentially increase in the future. For example, the watershed still contains a very high concentration of mining claims and if gold prices increase sufficiently, mining activity could increase. However, the shift from a large land based agrarian community to small residential communities is occurring as human immigration continues. Some of the more common land uses occurring on private lands within the watershed today include residential farming, small woodlot management, vineyards, and cottage industries.

Public lands within the watershed have become a recreational focal point for many Rogue Valley residents. Popular activities include: off-highway vehicles, camping, fishing, hiking, hunting, and horseback riding. Cantrall-Buckley county park receives a large number of visitors each year. Limited public access to the Applegate River restricts water-based recreation opportunities.

The recent population influx has also resulted in two distinct societal groups, the "oldtimers" and the "newcomers" (Preister 1994). The "oldtimers" are concerned about the loss of traditional economic sectors such as logging, and the "newcomers", place a higher priority on recreation and aesthetics. Despite their differences, both groups are concerned about the health of the ecosystem. This has resulted in the formation of several environmentally active groups within the AMA.

ISSUES AND KEY QUESTIONS

ISSUE: *Human Dimension*

KEY QUESTIONS
1. How have human activities affected land management?
2. How do human activities affect natural processes?
3. What are the current uses and how are they changing?

ISSUE: *Maintenance of Natural Processes and Functions*

KEY QUESTIONS
1. Are the "natural" functions and processes working?
2. How healthy is the ecosystem in the Middle Applegate Watershed?

ISSUE: *Need for Vegetation Management*

KEY QUESTIONS
1. Are plant species adapted to the environments in which they are found?
2. Are forests growing at an acceptable rate?

ISSUE: *Fire Risk and Fire Hazard*

KEY QUESTIONS
1. What is the risk or hazard to life, property, or of catastrophic loss?
2. What are the long-term ecological changes due to fire or lack of fire?
3. Where are the high fire risk areas?
4. Where are the high fire hazard areas?

ISSUE: *Special Status Species (Plant and Animal)*

KEY QUESTIONS
1. What special status species exist in the watershed?
2. What are the habitat conditions for special status species?
3. What are the conditions of the terrestrial ecosystem, and how do conditions of the terrestrial ecosystem in the watershed influence ecological diversity and maintenance of processes.?

ISSUE: *Water Quantity and Quality*

KEY QUESTIONS

1. What are the water quantity and quality concerns?
2. What has been the role of natural and management related disturbance in creating historic and current water quantity and quality concerns?
3. Where are sensitive areas (related to hillslope, hydrologic, and riparian vegetation) located within the watershed and what is the nature of the sensitivity?

ISSUE: *Riparian Areas*

KEY QUESTIONS

1. What was the prehistoric condition of riparian habitat within the watershed, and how was this habitat influenced by hillslope processes, hydrology, vegetation, and stream channel conditions?
2. What are the current conditions of riparian habitat, and how is habitat being influenced by hillslope processes, hydrology, vegetation, and stream channel conditions?
3. What has been the role of natural and management related disturbance in creating historic and current habitat conditions?
4. Where are sensitive riparian areas located within the watershed and what is the nature of the sensitivity?

ISSUE: *Fish*

KEY QUESTIONS

1. What was the prehistoric condition of stream habitat within the watershed, and how was this habitat influenced by hillslope processes, hydrology, vegetation, and stream channel conditions?
2. What are the current conditions of stream habitat, and how is habitat being influenced by hillslope processes, hydrology, vegetation, and stream channel conditions?
3. What has been the role of natural and management related disturbance in creating historic and current habitat conditions? What are the outside influences on aquatic resources? (i.e. Applegate Dam)
4. Where are sensitive areas for fish located within the watershed and what is the nature of the sensitivity?
5. What is the general health of fish and other aquatic resources?

PREHISTORICAL AND HISTORICAL CONDITIONS

The purpose of the Prehistorical and Historical Conditions section is to explain how human activities and natural disturbances have influenced current conditions in the Middle Applegate Watershed. Historical is defined as within the period of written record for the watershed. Prehistorical conditions are based on the Holocene period (approximately the last 10,000 years). Limited data exists for the Holocene period and it is only available for some ecosystem element conditions in the Middle Applegate.

Topics covered in this section include: Native Americans; early European and Euro-American exploration and settlement; commodity development for minerals, agriculture, and timber; residential growth; climate; geology; terrestrial vegetation; fire; air; wildlife species and habitat; water; riparian vegetation; and fish.

HUMAN DIMENSION

Native Americans

The earliest human occupation of the Middle Applegate probably did not occur until around 9,000 B.C. (LaLande 1995). These early inhabitants were probably small groups of nomadic hunters who followed the seasonal migration of big game animals (e.g., mastodon and other rapidly disappearing megafauna). They may have augmented their hunting of big game animals with other generalized hunting and gathering activities. There are no known archeological sites dating from this period in the Middle Applegate.

It wasn't until the cultural period of 7,000-2,000 B.C. that Northwest Native American groups began developing "central-based wandering" subsistence patterns (LaLande 1995). Tools from archaeological sites in the Applegate area dating from this period suggest increased processing and use of roots, bulbs, and nuts. Salmon may have been an occasionally used food source during the latter half of this period (LaLande 1995).

The next cultural period (2,000 B.C.-500 A.D.) witnessed steady population growth and a corresponding increased demand for resources (LaLande 1995). Population growth can probably be attributed to improved techniques for gathering edible plants and anadromous fish. Fire was used to maintain certain vegetation types and facilitate the growth of edible plants. Hunting of deer, elk, and other game continued to be important.

From 500 to 1700 A.D., the Applegate area continued to see increased population growth and more manipulative use of the environment for food production and gathering. The Upper Takelmas cultivated tobacco on land cleared by burning. It was the only known plant cultivated by the Takelma and other tribes in the area (Follansbee and Pollack 1978). Food surpluses of salmon, acorn meal, and camas bulbs enabled populations to cluster into growing winter villages (LaLande 1995). During warm seasons, village populations dispersed into extended family bands and pursued a "collector" subsistence with relatively well defined territories (Winthrop 1995a). This period may have seen the entry of the Athabaskan-speaking groups (e.g., the Dakubetede) from the north and east. There was an increased interaction between the residents of the Applegate Valley/eastern Siskiyous and groups living along the southern Oregon Coast and along northern California's lower Klamath River. People traded extensively, which promoted cultural exchange (LaLande 1995).

European and Euro-American fur trappers began to explore the Applegate area in the 1820s. Conflicts between the trappers and the Native Americans discouraged settlers. The discovery of gold in 1851 increased conflicts with the native people and eventually led to the Rogue Indian Wars of 1851-1856. Land clearing, farming, mining, and stock raising destroyed the aboriginal gathering and hunting sites. Deer and elk were hunted by settlers and herds were rapidly depleted. Finally in 1856 the native people were forcibly relocated to reservations in northern Oregon, leaving forever the land of their ancestors.

Early Exploration

The Applegate Valley, including the Middle Applegate, was one of the first areas visited at the beginning of this region's historic period. Peter Skene Ogden of the Hudson's Bay Company brought a brigade of fur trappers up the Applegate River about as far as Thompson Creek in April of 1827 (LaLande 1987). This brigade camped in the vicinity of the current town of Applegate. Seeking a trail south, Ogden sent scouts to explore tributary valleys, including Thompson Creek. Ogden experienced several visits from local Native Americans, and was discouraged from attempting to try to cross the Siskiyous to the south due to rugged terrain and mountain snows. His exit from the area was delayed when wolves ran off his herd of 50 horses (LaLande 1987).

The Applegate River was not frequented by other brigades traveling through, although the fur trappers operating in the region during the next several decades probably trapped along the river and its tributaries (LaLande 1987).

Mining

In 1851, gold was discovered near the present day community of Jacksonville. This discovery started a "gold rush" into most of southwest Oregon, including the Middle Applegate Watershed. During the 1850s and into the 1860s most of the mining activity was of the placer type: individual or small groups of prospectors working in or along stream channels (Follansbee and Pollack 1978). Most of the work was done using simple hand tools. The amount of disturbance to stream channels and riparian areas was relatively light when compared to later mining techniques (LaLande 1995). Drainages mined within the Middle Applegate Watershed were Forest, Poorman, Humbug, Thompson, and Keeler creeks.

As the easy gold was removed from these placer claims, miners began scouring the hillsides looking for the sources of placer gold deposits. Numerous lode claims were located and staked within the Middle Applegate Watershed during the 1870s and 1880s. Some of these lode claims, or "tunnel mines," still show on maps of the area and have become points of reference over the years. The Oregon Belle and Maid of the Mist mines are two examples of well known lode mines in the Middle Applegate.

Mining technology changed in the 1870s. Numerous drainages which had been previously placer mined were reworked with hydraulic equipment or large dredges. Forest Creek is a good example of a stream that was subjected to these types of mining activities. Hydraulic mining required a complex system of ditches to supply a steady source of water to the operations. Vast quantities of water were blasted at the stream banks to loosen tons of rock and soil for processing gold. Dredges also displaced huge quantities of rock and soil, but from the main stream channel, rather than from the adjacent side slopes. The stream channel and riparian vegetation in Forest Creek still show signs of this destructive process.

When the easier deposits were played out and gold was discovered in Idaho and eastern Oregon, agriculture became the predominant source of livelihood. However, mining continued to play a significant role in the development of the region. Mining activity again flourished during the Depression era of the 1930s and then all but disappeared during World War II, due to an executive order which curtailed gold mining during the war.

Agriculture

As the gold rush began to dwindle, agriculture became the economic mainstay of Jackson County (Follansbee and Pollack 1978). Grains and fruits were particularly well suited to the area's Mediterranean-type climate. Pasture land for livestock was developed using irrigation ditches built originally for hydraulic mining.

In the 1860s, stock raising initially centered upon hogs and was primarily for subsistence (LaLande 1995). Hogs commonly ranged in the mid-level oak woodland/transition pine forests where acorns, bulbs, and forbs were plentiful. However, livestock operations soon expanded and by the 1880s, tens of thousands of cattle and sheep were reportedly grazing the forests around the Applegate River (USDI and USDA 1994c). During the winter many herds subsisted on hay grown on irrigated pastures along the Applegate River. In the spring, the stock were turned out and allowed to roam to the uplands. In most cases, very little time was spent dispersing and moving herds, which led to many areas receiving excessive levels of utilization.

Agricultural expansion led to clearing native oaks and pines from valley bottoms and draining wet areas and floodplains to create additional farm land. This land was converted to large fields of oats, corn, alfalfa, and hay. As farming expanded, so did the demand for water. Large and small irrigation diversions proliferated resulting in an over-allocation of water by about 1900 (LaLande 1995).

In the mid-1880s, the arrival of the railroad in the Rogue Valley had far-reaching effects on agriculture. Products, such as fruit, were cultivated in great quantities for export to competitive markets. Diversified (subsistence-local market) farming became uneconomical, and many small farms died out because items were shipped in cheaply by rail.

Excessive livestock numbers, limited livestock management, and land alterations impacted vegetation structure and composition. The impacts were probably most significant in riparian areas (see Aquatic Components) and adjacent oak woodlands/savannahs where livestock often grazed year round (Brown 1960). Year-round grazing on overstocked range likely resulted in a decline in the abundance and vigor of perennial vegetation (Holechek et al. 1989). This increased the opportunity for introduced and noxious plant species to become established.

Degraded range conditions, the Great Depression, and increased federal involvement marked the 1930s as a major turning point in livestock management. Lands administered by the Department of the Interior were divided into allotments and assigned carrying capacities and grazing privileges. Stocking rates began declining and more attention was given to distributing livestock throughout an allotment with salt blocks or riders.

Logging

Prior to World War II, logging in the Applegate Valley consisted of a few family logging and milling operations, which produced small amounts of wood products for local use (LaLande 1995). Pine was preferred over Douglas-fir and stands were high-graded for the largest logs. As mining activity dwindled, timber harvest remained limited. LaLande (1995) notes that only two Applegate sawmills were recorded in a 1921 Forest Service management plan, both located in the Middle Applegate Watershed. One mill was on Thompson Creek and the other was about five miles west of Ruch.

After World War II, the post-war housing boom stimulated an enormous amount of timber production in southern Oregon. The Oregon State Conservation Act of 1941 began to require reforestation to ensure the continuing productivity of private forest lands. Compared to the rest of southern Oregon, the Middle Applegate had very little industrial land base. Only small sawmills and mobile logging outfits produced Douglas-fir two-by-fours for the housing market (LaLande 1995, Brown 1995).

In the Middle Applegate, intensive forest management practices began on Bureau of Land Management (BLM)-administered lands in 1959. These practices included the inventory of commercial coniferous forests and an annual timber sale plan for an annual allowable cut of 78.0 million board feet in the Jackson Master Unit. The majority of the Middle Applegate Watershed lies within the Jackson Master Unit, although a small portion (approximately one percent) is within the Josephine Master Unit. Operational sales included road construction and a tree planting program (USDI 1975).

In 1972, the State of Oregon legislated the Forest Practices Act which addressed all forest operations, including road construction and maintenance, timber harvesting practices, chemical use, slash disposal, and reforestation requirements (Pacific Logging Conference 1981). The act was amended in 1993 to provide additional protection for water quality and riparian vegetation.

On BLM-administered lands the common logging systems in the 1960s included tractor harvest on gentle to moderate slopes and high lead cable system on steep slopes. During the mid 1970s skyline cable logging systems began to replace high lead cable logging systems and tractor logging was limited to the gentle slopes. During the early 1980s soil compaction concerns led to summer logging and designated skid roads with bull line pulling for tractors and the complete use of one-end suspension (skyline) cable yarding systems.

After the 1987 fires, the enormous volume of dead, salvageable trees and the lack of roads limited conventional logging. Helicopters were used to access areas with few roads and low harvest volumes per acre. The first use of helicopter logging in the Middle Applegate was in the Ninemile area to salvage fire-killed trees.

As had occurred elsewhere in the northwest, populations of animal species dependent on large areas of old-growth were steadily declining by the 1970s. Logging, other than salvage logging, on federal land in the Middle Applegate Watershed virtually halted in 1991 with the U.S. Fish and Wildlife Service listing the northern spotted owl as a threatened species under the Endangered Species Act (1973).

Transportation

Native American and pioneer trails were developed into wagon roads for early settlers in the mid to late 1800s. Somewhat later, roads were constructed for ranching and mining. Many of today's major roads were originally trails which, over the years, developed into a highway or a major road. Eventually a road system developed for various recreational activities, homesteads, logging, fire access, and other land uses. Historically the BLM emphasized timber management and developed a road system for access to timber and other forest resources. Timber sale revenue paid for the majority of road construction and maintenance.

Growth and Growth Patterns

The development of southwest Oregon followed a different pattern than most other western areas. Usually, fur trappers paved the way for pioneer homesteaders, but in the Applegate, mining preceded agriculture. A number of miners saw agriculture as a more predictable and stable livelihood. These farmer/miners acquired Donation Land Claims. They farmed in the spring and summer and mined during the fall and winter. The large influx of miners in the 1850s also stimulated the development of towns, roads, agriculture, and a legal and social order. Mining Districts began to form. The Applegate District was formed in 1853 followed closely by the Foots Creek District (adjacent to the north side of the Middle Applegate Watershed).

After the initial miners and farmers settled in the fertile valley bottoms, growth continued in largely speculative homesteading ventures in the foothills on marginal-quality federal land. Short influxes of largely seasonal residents associated with mining occurred periodically from 1850 to 1940 and again during the Great Depression with increased numbers of federal projects (Preister 1994). The post World War II period saw a steady increase in the permanent population attracted by the pleasant surroundings and improved roads and communication.

The area remained primarily agriculture and timber based until the late 1960s and early 1970s when a number of large land holdings, primarily farms and ranches, were divided into 5 to 20 acre homesite parcels in anticipation of stricter land use regulations. These parcels became "hobby" farms usually to take advantage of tax incentives for agriculture production (Preister 1994). As more and more Applegate Valley residents commuted to outside communities for work, the local economic base shrank considerably. Construction of larger and more expensive homes drove up property values in the area.

As the population influx continued, the availability of desirable and accessible parcels on the valley bottom quickly disappeared. Valley property values kept increasing, and residential areas expanded into upper valleys and hillsides. In the Middle Applegate this occurred on Thompson, Humbug, and Slagle creeks, the Cantrall-Buckley area, and to a lesser degree on Forest and Bishop creeks.

Demographic Changes

Prior to 1960, growth in the Middle Applegate was slow enough that new residents could easily be absorbed into the rural, agricultural community. The majority of these newcomers adopted the rural lifestyle (Preister 1994). The big growth period beginning in the late 1960s resulted in several changes. The sheer number of people moving into the area was too large to be absorbed easily into the existing community. In addition, many new residents were retirees or commuted to urban areas in the Rogue Valley (Preister 1994).

With improved roads and a shrinking economic base, local services became concentrated resulting in the disappearance of small post offices, stores, schools, and other services. As more people began commuting to the Rogue Valley for employment, they used the land more for recreation than for economic livelihood. This lifestyle change has affected public opinion regarding BLM land management in the Middle Applegate. The Middle Applegate still retains its rural, agricultural culture and affiliation, but a "sense of community" seems to be dwindling (Preister 1994).

Environmental Era

Between 1960-1980, there was a growing awareness in southern Oregon, as well as the rest of the United States, of how human activities were affecting the environment. This "awareness" led to the passage of several landmark pieces of legislation, for example: the National Environmental Policy Act of 1969 (NEPA), the Clean Air Act (1970), the Clean Water Act (1972), and the Endangered Species Act (1973). The Federal Land Policy and Management Act (1976) established policy for the management of BLM lands. Society began to require that federal agencies produce commodities from public lands within a context that continued to protect or enhance environmental and amenity values such as viewsheds and recreation.

Residents of the Middle Applegate Watershed had growing environmental concerns about public land management. They formed several interest groups including the North Applegate Watershed Protection Association, the Thompson Residents for Ecological Education, the Applegate Watershed Conservancy, and later, the Applegate Partnership. The Applegate Partnership concept went on to serve as the template for public involvement in the 1994 Northwest Forest Plan (USDA and USDI 1994a).

Archaeological Sites

No traditional cultural properties or areas of historical religious significance have been recorded for the watershed.

The BLM site files list eleven formally recorded sites and isolates (sites with less than 10 artifacts) within the Middle Applegate Watershed. Nine of these are sites relating to the historic period; two are prehistoric sites. Of the prehistoric sites, one is a site containing re-buried Native American remains; the other is an isolated Native American artifact recorded on private land.

The historic sites are listed in the Archaeology Report (Winthrop 1995b). The sites relate to mining and early settlement, and include placer and lode mining sites, an abandoned homestead site, and dumps.

It is unlikely that any of these historic sites would meet the tests for National Register significance. Collectively, however, they represent the remains of important historic activities in the Middle Applegate Watershed, and span the last 100 years.

There has been little systematic archaeological survey in the watershed, although a survey associated with a recent project did provide some information regarding the types of sites likely to occur (Stepp 1995). Several of the historic sites noted above were recorded during this project. In addition, a survey currently in progress along Thompson Creek has located a number of mining-related sites, especially along the east side of the creek (Gray 1995).

These surveys demonstrate that mining and early settlement sites are likely to occur within the Middle Applegate Watershed, especially along the river and drainages.

Intensive surveys outside the watershed, but in the Applegate, have located numerous sites from the period of Native American habitation. Within the Applegate, early mining activity along the creeks and the Applegate River probably destroyed the remains of some earlier native encampments. Isolated finds and sites from just outside the boundaries of the Applegate Subbasin, however, suggest that prehistoric sites may occur along undisturbed portions of the Applegate River and its tributaries. Such sites would occur primarily on terraces and benches along the river, on flats above drainages, and around upland meadows. Sites may also be associated with springs and small drainages.

TERRESTRIAL COMPONENTS

Climate

Recent work in the Pacific Northwest has identified a climatic sequence for the Holocene which probably applies to interior southwest Oregon (Thompson et al. 1993). After the demise of the great continental glaciers, between about 14,000 and 10,000 years ago, the northern hemisphere experienced an amplified seasonal cycle of solar radiation lasting until about 6,000 years ago. During this time, summer solar radiation was greater and winter radiation was less than today. The resultant increased temperatures and decreased effective moisture produced a warm, dry interval (Whitlock 1992). After about 5,000 or 6,000 years ago, this xeric period began to moderate. Throughout the region, modern vegetation patterns began to appear, and were established by about 3,000 years ago (Whitlock 1992).

More "recent" climate changes may also have fluctuated widely. From about 900 to 1100 A.D. and from around 1200 to 1350 A.D., intense droughts may have characterized southwest Oregon during the "Little Climatic Optimum." On the heels of these local droughts came a global climatic sub-period called the "Little Ice Age," an extended period of cool, moist weather (with a temperature mean about 0.5 degree C below modern levels), which lasted from about 1350 A.D. through the mid-nineteenth century (LaLande 1995).

Based on tree-ring growth rates and recorded meteorological data, the past 200-to-300 years have probably been marked by cycles of hot, dry spells and temperate-to-cool weather that have lasted varying periods (LaLande 1995). Southwest Oregon may have experienced a severe 30-to-40-year drought during the middle part of the eighteenth century.

Geology

The Middle Applegate Watershed lies within the Klamath Mountains Geologic Province, which is a north-trending, elongated area of approximately 12,000 square miles in northern California and southwestern Oregon. The Klamath Mountains Geologic Province contains some of the oldest rock formations in Oregon, including the Applegate Formation. Rocks of the Applegate Formation have undergone various degrees of metamorphism; the most severe occurred along the Oregon-California border at the headwaters of the Applegate River. The metavolcanic rocks and granitics are typical of the Applegate Formation, which underlies the entire Middle Applegate area.

In the Middle Applegate, the drainage system was developed by the late Miocene (approximately 13 million years ago). The Applegate River drained into the Rogue River. The Applegate River and its major tributaries, such as the Little Applegate River and Forest Creek eroded broad valleys. Minor tributaries incised deeply into steep hillslopes. Thick deposits were formed at the mouths of major and minor tributaries.

During the last 10,000 years, volcanic eruptions in the southern Cascades and normal geologic processes, such as water erosion, deep weathering, and colluvial movement have continued to modify the landscape.

Terrestrial Vegetation

Endemic vegetation in the Middle Applegate Watershed is a result of climate fluctuations and the unique geology of the area. The Siskiyou Mountains of the Klamath Mountains Geologic Province served as a link between the Cascade Mountains and the Oregon and California coast ranges. Over the last 60 million years vegetation has migrated into this area from six different directions: the Oregon and California coast ranges (red alder, Pacific madrone and bigleaf maple); the Sierras and Cascades (baneberry, Shasta red fir, sugar pine, manzanita spp., and California black oak); and the Klamath River corridor and lowland chaparral areas (juniper and mountain mahogany) (Atzet 1994).

From 1350 A.D. through the mid-nineteenth century, the landscape pattern had a high degree of variation in vegetation condition class, structure, and the arrangement and composition of plant species. Historically, forest stands had fewer trees per acre, trees of larger diameter, and a different species composition because of the more open conditions. These stands were composed of more ponderosa pine, oak species, incense cedar and native grasses. During this time period, the climax seral vegetation stage was probably never reached because of frequent fire disturbances. Not only were natural lightning fires common, but Native Americans and Euro-American settlers used fire to clear land for various purposes. Natural and anthropogenic fire disturbances combined with mining, logging, agriculture, and other factors caused by urbanization, resulted in reduced endemic tree and shrub densities. The more recent introduction of non-native grasses and their spread altered the vegetative composition.

Precise historical data or specific biological data on rare plants in the Middle Applegate Watershed is not available. However, data for the two orchids, *Cypripedium fasciculatum* and C. *montanum*, suggests they were more common. These two species are closely associated with late successional forests and possibly require fire for the maintenance of viable populations.

Fire and Air

Major stand replacement fires have been documented within the Applegate prior to the 14th century (LaLande 1995). Most were apparently associated with extended droughts. Native Americans utilized fire for a number of purposes, from preparing tobacco beds to improving mast (acorn) production. These fires were usually high frequency, short duration ground fires. Settlers, arriving in the 1850s, continued this practice of altering the vegetation. However, their purpose was to clear land for agriculture and mining (LaLande 1995).

Major fires in the Middle Applegate Watershed were documented during the following years; 1864, 1869 through 1874, 1883, 1885, 1889, 1902, 1910, 1914 through 1917 (LaLande 1995), and 1987.

As settlement increased throughout the Rogue River Basin, air quality became an issue. Dense clouds of smoke were said to fill the valley hindering visibility and creating unhealthy conditions (Morris 1934). This issue of air quality combined with the desire to protect timber led to organized fire suppression, which began in 1902 (USDI and USDA 1994c). Fire suppression combined with extensive logging beginning in the 1950s changed the extent and role of fire on the landscape (USDA 1990). Fire suppression reduced the occurrence of low-to-moderate severity fires and allowed fuels to accumulate.

Hot, dry summers combined with lightning storms produced a yearly summer fire season. In recent years accidental fire starts or purposeful arson has been a problem. The Oregon Department of Forestry reported that in an 11 square mile area around the town of Applegate 41 fire starts were investigated and suppressed from 1969 to 1994 (Yocum 1995).

Wildlife Species and Habitat

Wildlife populations in the Middle Applegate Watershed, like all watersheds, have historically been influenced by natural perturbations and human activities. Since the mid 1800s, human activities have unquestionably had a greater influence on wildlife in the Middle Applegate Watershed than natural disturbances.

Native Americans hunted various wildlife species for subsistence, but had little long-term influence on wildlife populations due to the rather small scale of the hunts and the lack of sophisticated weapons. The only notable impact of Native Americans was the use of fire to rejuvenate grasslands and rid some areas of brush (LaLande 1995). This use of fire improved habitat conditions for species preferring early seral vegetation, such as black-tailed deer and elk, animals the Native Americans relied on for food.

After the arrival of the gold miners in the 1850s, there was a prodigious increase in both direct and indirect human impacts on wildlife. Furbearers were persistently trapped; predators such as wolves, coyotes, and cougars were hunted for bounty; and deer and elk were hunted for market. During this period bighorn sheep, gray wolves, and grizzly bears were extirpated from the watershed and other species were reduced in number (LaLande 1995).

Habitat changes occurred at a larger scale after the arrival of gold miners, especially in the bottomlands along rivers. The infrastructure to accommodate greater numbers of people as well as mining techniques like hydraulic mining, hillslope blasting, and stream channel dredging, affected many species. Land clearing for agricultural purposes changed the vegetative composition of much of the bottomlands. Populations of some native species, such as acorn woodpeckers, were reduced due to these operations.

After the turn of the century, state and federal laws were enacted to protect many wildlife species from overexploitation. In some cases this helped to stabilize and then improve populations such as black-tailed deer, but in other cases it was too late, species such as grizzly bear were gone from the region.

It was also during the early 1900s that wildfire suppression was implemented on a large scale. Although this activity had no immediate impact on wildlife, in the long-term it has influenced the vegetative composition and structure which in turn influenced wildlife diversity, abundance, and distribution in the watershed.

World War II, with its influence on technology and the increased the need for raw materials, resulted in greater change to forested habitats in the watershed. The shift from small-scale, selective harvests for homebuilding and firewood to large-scale (up to a section in size) clearcuts to satisfy growing market demands changed habitat conditions and wildlife populations and distributions were influenced accordingly.

Since World War II, timber harvest, fire suppression, and residential development have exerted the greatest influence on wildlife in the watershed.

AQUATIC COMPONENTS

The *Applegate River Watershed Assessment: Aquatic, Wildlife, and Special Plant Habitat* (USDA and USDI 1995a) provides a perspective of how the Applegate River and it tributaries might have appeared prior to the coming of European settlers in the 1820s. Upland areas were a matrix of forests and meadows. Riparian habitat had a diverse mix of species and age classes, and the streams were stable, with ample coarse woody debris and good water quality. Beaver were abundant in tributaries and along the main Applegate River. Resident and anadromous fish were abundant.

Europeans first influenced riparian systems in the Middle Applegate Watershed when Hudson Bay trappers arrived in the 1820s and began pursuing beaver. Beaver populations were drastically reduced (LaLande 1995). Because beaver dams store nutrient-rich fine sediments and reduce water velocities, loss of beaver dams could have promoted down-cutting or incising of stream channels, and fine sediment deposition in scour pools.

Gold mining began in the 1850s and developed into large-scale hydraulic mining by the 1870s. The Applegate River and most of its tributaries were subject to at least some level of channel alteration, water diversion, and turbidity. Bucket dredging of the stream bed occurred in several areas, but was extensive on lower Forest Creek.

Water diversion ditches were first constructed for hydraulic mining in the 1870s. By the turn of the century, farmers and ranchers had considerably expanded the water diversions for irrigation systems. Flows were diverted from every perennial stream in the watershed to the extent that most streams were over-appropriated by 1900 (LaLande 1995).

The effects of mining on fish were very severe. Early newspaper accounts told of miners catching salmon and steelhead in their sluices, but the greatest losses occurred when eggs suffocated in sediment-clogged spawning beds and juvenile rearing habitat was reduced or eliminated by prolonged wintertime periods of "brick-red" streamflows (LaLande 1995). These losses were exacerbated by the myriad of unscreened irrigation ditches that diverted young fish into fields, and by the irrigation water withdrawals that left insufficient flows and high water temperatures in downstream fish-rearing areas (LaLande 1995).

Livestock production was a major industry in the Applegate between the 1880s and 1930s (see Agriculture). Overstocking of the mid-to-high elevations, year-round use on lowlands, and burning of vegetation by ranchers undoubtedly had severe impacts on water quality, riparian vegetation, and subsequently on fish resources (LaLande 1995).

Livestock grazing, conversion of forests to farm land, flooding, and bank scouring prevented conifer re-growth. Species composition in the valley bottoms changed from large conifers with a diverse variety of deciduous trees and shrubs to thin bands of vegetation along stream banks. Later, riparian zones became choked by introduced Himalayan blackberries.

Logging operations in the late 1800s and early 1900s primarily removed the large pine and fir trees in valley corridors because they were the most accessible. Logging became a major influence in the Middle Applegate Watershed during and after World War II. Logging activity moved into headwater areas where road building and large-scale clearcut logging resulted in accelerated annual runoff, sedimentation, and stream channel alteration (LaLande 1995).

Prior to human influences, coarse woody debris in stream channels, floodplains, and riparian zones was periodically moved downstream by major flood events in the Middle Applegate. Coarse woody debris that moved out of a stream system was replaced by trees falling from adjacent forested stands. Human activities such as mining, agricultural development, logging, and road construction, removed riparian vegetation and reduced the future source of coarse woody debris. Some logging operations in the 1960s and 1970s removed coarse woody debris from streams and riparian zones along with logging slash. In addition, following the 1974 flood, the Corps of Engineers and Soil Conservation Service removed coarse woody debris from the Applegate River with the intention of protecting streambanks and preventing further property damage.

For additional information on the prehistoric and historic conditions for aquatic resources refer to the Riparian and Fish Report (Haight 1995).

CURRENT CONDITIONS

HUMAN DIMENSION

Native Americans

The native inhabitants of the Middle Applegate were removed to the Siletz and Grand Ronde reservations in northern Oregon after the "Indian Wars" of 1851-1856. Today, their descendants are members of the Confederated Tribes of the Siletz and the Confederated Tribes of the Grand Ronde. Both tribes are Federally recognized, and are active in promoting the heritage and current welfare of their members. As federally recognized tribes, the Siletz and Grand Ronde are accorded governmental status. The Siletz are also a "compact tribe", according to the Tribal Self-Governance Act (1994), and may assume responsibility for certain aspects of federal government programs within the Department of the Interior.

Mining

Based on Bureau of Land Management (BLM) microfiche records from August 15, 1994, there are over 100 valid mining claims (both active and inactive) located on BLM-administered lands within the Middle Applegate Watershed. Claims are primarily for gold and silver. Approximately 40 percent of these are placer claims and the other 60 percent are lode claims. The number of valid claims constantly changes due to fluctuating gold prices and changes in claim registration fee regulations. Mining claim records are maintained by the BLM State Office in Portland, Oregon.

Grazing

Livestock are a common sight on private land. However, these operations are relatively small and are usually not relied upon for primary economic support. Presently, only five or six Applegate Valley residents identify themselves as ranchers (Preister 1994). Occasionally, livestock from private ranches "wander" onto BLM-administered lands.

Allotment files reveal a continuing decline in livestock use on BLM-administered lands within and around the Middle Applegate Watershed. Currently all or part of eight grazing allotments occur within the watershed. They are displayed on Map 4 and listed in Table 3. Due to financial hardship, resource conflicts, and the death of a permittee, six allotments are vacant (Moore 1995).

Table 3. Grazing Allotments Within the Middle Applegate Watershed.

Allotment	Status	Preference (AUMs)[1]	Season of Use
Applegate[2]	vacant	672	4/15 - 6/30
Billy Mountain	active	534	4/16 - 6/15
Chapman Creek	active	81	4/16 - 7/22
Lomas Road[2]	vacant	50	4/16 - 6/15
Spencer Gulch[2]	vacant	150	4/1 - 6/30
Star	vacant	24	5/1 - 8/31
Sterling Creek[2]	vacant	478	4/16 - 6/30
Timber Mountain	vacant	70	4/16 - 7/15

1/ AUMs = animal unit months. One AUM is the amount of forage required to sustain one cow with one calf, or their equivalent, for one month.
2/ Less than 70 percent of allotment is within the watershed.

Logging

In the Middle Applegate Watershed, approximately 70 percent of BLM-administered land is designated as commercial forest land (Micro*STORMS database). On the BLM commercial forest land, no timber harvest has occurred on 39 percent, 35 percent has received various harvest treatments (including selection, shelterwood, overstory removal, thinning, and clearcut), and 26 percent has had only salvage harvest.

In the early 1990s, a salvage program was conducted primarily with helicopters in response to a drastic increase in tree mortality. Tree mortality increased in the late 1980s and early 1990s as a result of drought conditions combined with overstocked stand conditions (USDI 1993).

The Middle Applegate Watershed lies within the Applegate Adaptive Management Area (AMA), which was created by the 1994 Northwest Forest Plan. The AMA is designed to develop and test new management approaches to integrate and achieve ecological, economic, and other social and community objectives (USDA and USDI 1994a). The emphasis of the Applegate AMA includes the development and testing of forest management practices, including partial cutting, prescribed burning, and low impact approaches to forest harvest, such as using aerial systems, that provide for a broad range of forest values, including late-successional forest and high quality riparian habitat.

The majority of private forest lands in the Middle Applegate are small woodlot holdings. Based on operation permits received by the Oregon Department of Forestry, there has been a substantial increase in harvesting on private lands during the 1990s. This increase is due to high timber values. Demands for new housing combined with a limited federal timber supply are suspected to be the cause of high timber values. The majority of private timber land is harvested using tractors.

Preister (1994) concluded that residents in the Applegate support a "balanced" approach to forest management. Residents oppose clearcuts and are concerned about the number of dead and dying trees. There is a growing group of private forest land owners working with the Applegate Watershed Council, the Rogue Institute for Ecology and Economy, and the State of Oregon to improve the condition of their forested stands.

Transportation

Roads in the Middle Applegate Watershed are owned or managed by a wide variety of organizations or individuals, including the BLM, private timber companies, Oregon Department of Transportation, Jackson County, and numerous private landowners. Road conditions vary from primitive 4-wheel drive roads to a paved major state highway (i.e., Highway 238). Cars, trucks, motorcycles, bicycles, horses, and pedestrians all traverse these forest roads for commerce, recreation, resource management, and access to private property.

BLM's transportation system objective in the Middle Applegate is to provide many different recreation experiences and management opportunities while at the same time protecting resources, minimizing safety hazards, and reducing user conflicts. BLM roads are generally open for public use unless blocked by gates or other methods to protect resources. At this time, approximately 35 miles of BLM-controlled roads in the Middle Applegate are located behind road blocks.

BLM's Geographical Information System (GIS) and Transportation Information Management System (TIMS) identify a total of 539 miles of road in the Middle Applegate Watershed, of which 186 miles are controlled by the BLM. BLM-controlled roads include 70 miles of natural surface roads, 108 miles of rocked roads, and 8 miles of paved (bituminous surfaced) roads. BLM's inventory contains very little information about non-BLM controlled roads.

The recent decline in timber harvest on BLM-administered lands has seriously reduced timber revenues, which support the road maintenance operating budget. This has limited the BLM's ability to finance maintenance of extensive road systems. Road maintenance includes road surface improvements, hazard tree removal, and improving water drainage.

Many of the roads in the watershed have reciprocal road use agreements between the BLM, private timber companies, and some private land owners. The BLM charges fees for commercial use of BLM-controlled roads with revenues from these fees being used to help pay for maintenance of BLM roads. The BLM is charged fees for commercial use of private roads included in the agreements.

Rights-of-Way

The BLM has granted 12 rights-of-way giving legal authorization for use of BLM roads within the Middle Applegate. These rights-of-way are held by individuals and/or private companies who need long term authorization to access private land. The BLM has also granted 24 rights-of-way for utility lines, water lines, irrigation ditches, and communication sites. Very often, these rights-of-way include the use of a road.

In addition to right-of-way grants, there are 11 other uses that have been authorized for various purposes. Roads may be an incidental use in some of these cases, but most of them are not connected to the transportation system.

Recreation

Recreational activities in the Middle Applegate have remained relatively unchanged over the years. Most of the recreational activity in the area consists of dispersed activities such as hunting, hiking, mountain biking, motorized sightseeing, nature viewing, and fishing. Some weekend recreational mining occurs. Recreational miners primarily use pick and shovels but occasionally operate small suction dredges.

There are some partially developed recreation sites that were established primarily through repeated use. These include the hang-gliding site on Woodrat Mountain and a few off-highway vehicle (OHV) trails primarily in Ferris Gulch and the Thompson and Forest creek drainages. There are also some short hiking trails developed and used by local residents. Examples are the Enchanted Forest and Long Gulch trails.

In 1993, BLM and others constructed the 1.2 mile Felton Memorial Trail from the Enchanted Forest Trail to a helicopter crash site memorial in recognition of co-workers who lost their lives in that crash.

Social/Economic Development and Rural Interface

Land use constraints (such as county zoning regulations) continue to focus development into already established areas. Remaining developable land is becoming increasingly expensive, making a self-sufficiency lifestyle more difficult to attain. Commuting and two wage earners per family are becoming more common due to the local, low employment base. Traffic and related problems are the primary community complaint (Preister 1994).

There continues to be more "hobby farms" and small woodlots rather than self-sufficient farms and ranches. Hay and some cattle production are the principle agricultural products produced on these "hobby farms" (Preister 1994). Other "hobby farms" specialize in vineyards, fruit and nut orchards, and exotic species such as llamas. Small woodlot owners also represent a sizable share of the forest production in the Middle Applegate.

While there is strong community support for agricultural and forest commodity production, there is an increasing emphasis on protecting amenity values such as scenic views and long-term forest health. Recent drought years have focused community attention on the removal of dead/dying insect infested trees and reducing fire hazards. Community residents are also concerned about protecting wildlife. A reduction in available wildlife habitat has resulted from residential development intruding into previously forested areas. Conflicts between humans and wildlife, especially cougar and coyotes, have increased.

Protection of life and property is a wildfire suppression priority. The diversion of fire suppression resources to protection of life and property reduces the agencies' capability to protect forest resources. Expanding rural interface areas also continue to hamper efforts to reintroduce fire into the ecosystem through prescription burning. The need to protect private property and to maintain certain air quality standards to protect public health are making successful prescribed burns more difficult to achieve.

Additional problems stemming from interface development include safety and unauthorized use. Road maintenance and dual use of logging roads for access to private property and for hauling logs are safety concerns.

Unauthorized uses include: timber, mineral, and rock theft; grazing and agricultural trespass; illegally built roads, landings, driveways, and trails; and structures, fences, supplies, and refuse constructed or placed on public lands. The BLM attempts to resolve the unauthorized uses through administrative, civil, or criminal actions. In many cases, the BLM actively pursues the perpetrator of the illegal activity and collects for damages resulting from the action. In other cases, the use is authorized through an administrative action such as a right-of-way or lease.

Timber trespass and other unauthorized uses occur frequently in rural interface areas. Timber trespass may be occurring less than in the past due to more careful monitoring of property lines in recent years. Garbage dumping on public lands is increasing in rural interface areas especially when landfill fees increase. Over the past several years the Medford BLM has worked closely with county planners in an attempt to head off potential problems associated with development of rural property in these interface areas. The number of unauthorized use cases connected to recent residential development appear to be decreasing.

Archaeological Sites

The historic sites which exist within the watershed are in various states of decay. None of these sites has been formally evaluated, and their research (scientific) or heritage values (interpretive) remain undefined. Due to the abundance and variety of historic resources, it is likely that National Register quality sites may occur within the watershed. It is also likely that local groups may express an interest in some of the historic materials and wish to see them preserved.

Site looting is a critical problem within the watershed. A site recently discovered along Thompson Creek contains the remains of an early twentieth century homestead. Although the buildings are gone, an extensive dump remains, consisting of several thousand artifacts. Dumps such as these provide an intimate glimpse into the every-day lives of early settlers, and such a dump could possess both scientific and heritage values. According to the cultural resource contractor who discovered the site, this historic resource has been badly looted within the very recent past (early 1995).

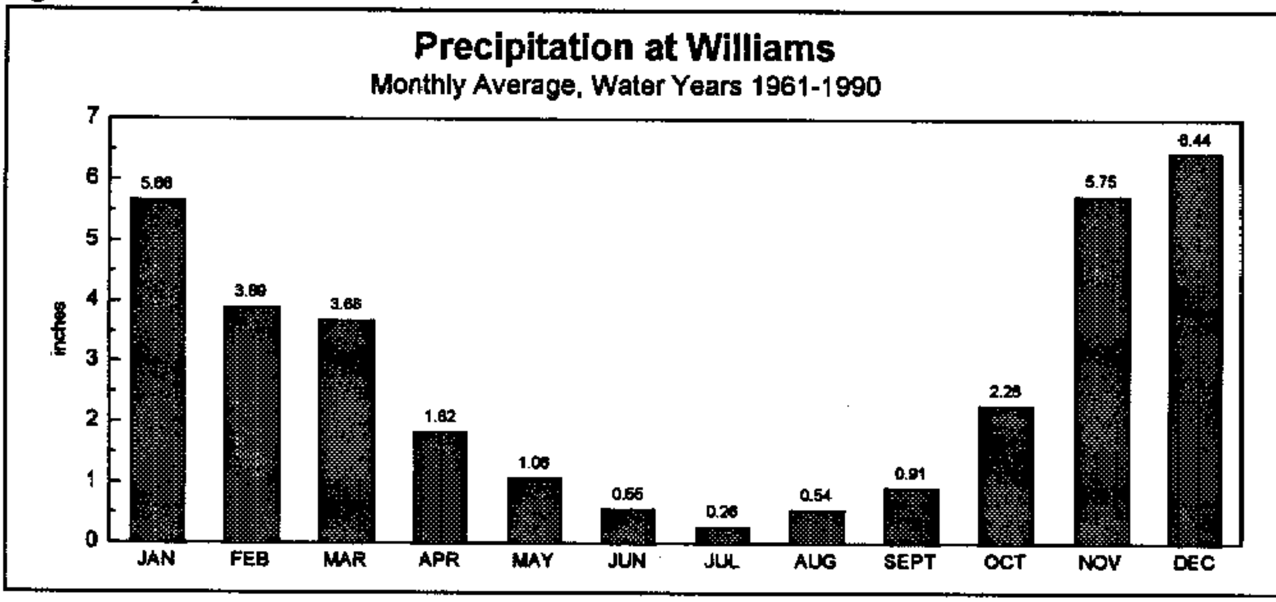
TERRESTRIAL COMPONENTS

Climate

The Applegate Valley is one of the driest areas west of the Cascade Mountains. Average annual precipitation in the Middle Applegate Watershed ranges from approximately 25 inches near Applegate to 60 inches at Humpy Mountain (Map 5). Precipitation usually occurs in the form of rainfall over most of the watershed; however, between approximately 3,500 feet and 5,000 feet, a mixture of snow and rain occurs (Applegate River Watershed Council 1994). This elevation band is referred to as the transient snow zone and comprises eight percent of the Middle Applegate Watershed (Map 6). The Middle Applegate Watershed does not contain any snow dominated areas.

The National Oceanic and Atmospheric Administration (NOAA) weather station at Williams, just outside the Middle Applegate Watershed boundary, has the most complete precipitation record of any station in the vicinity. Precipitation distribution at Williams by monthly average is shown in Figure 1. Seventy-seven percent of the yearly precipitation falls during November through March.

Figure 1. Precipitation at Williams



Source: Data provided by Oregon Climate Service (30-year average from 1961-1990, Oct.-Sept. water year)

One BLM (Upper Star Gulch) and four NOAA weather stations are in the vicinity of the Middle Applegate Watershed and have varying periods of record. The 30-year average annual precipitation at Williams was used to estimate 30-year average annual precipitation rates for the Applegate and Upper Star Gulch weather station sites (Table 4).

Table 4. 30-Year Average Annual Precipitation

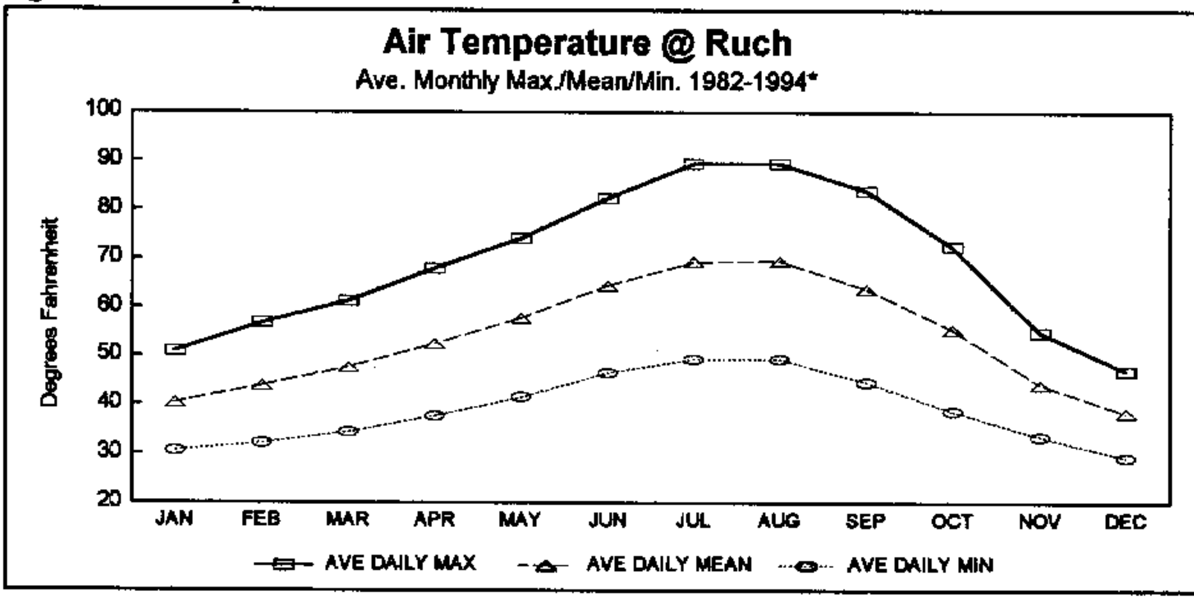
Weather Station Location	30-year Average Annual Precipitation (inches)
Applegate	24.67[1]
Buncom	22.78
Ruch	25.42
Upper Star Gulch	32.40[1]
Williams	32.85

1/ estimated using partial station data correlated to Williams data.

Williams has experienced below normal (30-year average) precipitation during eight of the past ten years (Lindell 1995). Six of the eight years with below normal precipitation were below normal by more than 20 percent. The 3-year, 5-year, and 10-year cumulative precipitation deficits for 1994 at Williams are 21 inches, 43 inches, and 62 inches respectively (Lindell 1995). Current low soil moisture conditions in the Middle Applegate Watershed are a reflection of the cumulative precipitation deficits.

Average monthly maximum, mean, and minimum air temperatures for Ruch are displayed in Figure 2. Summer months are predominately hot and dry. Maximum temperatures averaged 89°F at Ruch in July and August during 1982-1994. Summer temperatures are normally accompanied by low humidity typical of a Mediterranean-type climate (USDI 1994).

Figure 2. Air Temperature at Ruch



* Station inactive 5/91-10/92; additional 15 months partial data, 4 months no data. Source: NOAA Climatological Data

Prevailing winds are from the north or northwest and usually light. Summer thunderstorm activity is common. Many of these storms are unaccompanied by measurable rainfall resulting in numerous lightning-caused fires. Winds in excess of 50 mph, from any direction, are common. Most of these storms enter the area from the south or southwest (USDI 1994).

Geomorphology

Two physiographic provinces are located within the Middle Applegate Watershed, the Western Oregon Interior Valleys Province and the Klamath Mountain Province (USDA 1993). Physiographic provinces are broad divisions of landforms. The Western Oregon Interior Valleys Province consists of alluvial surfaces including floodplains, stream terraces, and alluvial fans. The Klamath Mountain Province is comprised of the lower to upper mountain or hill slopes.

Upstream of the Middle Applegate Watershed, the Applegate River flows in a general north-northeastward direction to the junction with the Little Applegate River. After the confluence with Little Applegate River, it flows northwest through the Middle Applegate Watershed into Josephine County and the confluence with Williams Creek. Over its course through Jackson County the Applegate River falls at a rate of approximately 23 feet per mile. The floodplain and terraces above the active channel average about a quarter-mile wide. The lower floodplain is subject to flooding on an annual basis while the upper floodplain is periodically inundated every five to 100 years. These are low relief surfaces with stream channels, point bar deposits, and abandoned meanders on the lower surface and common overflow channels on the upper floodplain.

The stream terrace, above the floodplain, rarely floods. This is a very low relief surface with subtle bar-and-channel topography. The lower terraces represent recent alluvium and younger stream deposits. In some of the lower terraces, gold has been mined and most of the dredged areas have been restored for agricultural purposes.

The highly dissected terrace or alluvial fan, above the stream terrace, is not subject to flooding. It is associated with uplands and has gentle to moderate slopes that are dissected by small upland streams. This is the oldest surface (100,000 to 500,000 years) in the Middle Applegate. The narrow, upper terraces merge with the lower slopes.

The lower slopes within the Klamath Mountain Province, adjacent to and above the terrace, are highly dissected, with moderate to steep slopes of 20 to 50 percent. Soils developed in accumulated weathered colluvium (rocks and soil that have moved down slope).

The upper slopes are moderately dissected and very steep, 50 to 75 percent. Soils have developed in weathered colluvium.

Soil

Soil Descriptions

Soils in the Middle Applegate Watershed were formed in thick, usually unconsolidated deposits of various ages. The most common upland soil series include Caris, Offenbacher, Vannoy, Voorhies, and Tallowbox. Caris and Offenbacher occupy approximately 31 percent of the Middle Applegate Watershed and commonly occur on steep to very steep slopes. Both soils have developed from well drained colluvium. They are typically 20 to 40 inches deep; overlying fractured metamorphosed volcanic bedrock. Caris contains a dark brown, gravelly loam over dark, very gravelly clay loam subsoil. Offenbacher has a grayish brown gravelly loam over reddish brown loam subsoil. Both soils are stable and permeable. Landsliding is rare for these soils (USDA 1993).

Vannoy soil occurs in approximately 18 percent of the Middle Applegate and developed on moderate to steep slopes from metamorphic material. It is well drained and typically 20 to 40 inches deep. Vannoy has a dark brown silt loam surface over yellowish red clay loam subsoil. It has low strength and is only moderately permeable due to a relatively dense subsoil. Surface protection is warranted due to slow infiltration rate upon disturbance. The Vannoy-Voorhies complex is found in approximately 18 percent of the Middle Applegate. Voorhies has a dark brown gravelly loam over brown gravelly clay loam subsoil (USDA

1993).

Tallowbox soil occurs in approximately five percent of the Middle Applegate and developed on steep to very steep slopes from granitic rock. It is excessively drained and typically 20 to 40 inches deep. Tallowbox has a dark brown gravelly sandy loam surface over gravelly sandy loam subsoil and is very permeable. It is subject to very high erosion when not protected (USDA 1993).

Slope Processes

The major erosional/depositional processes naturally occurring on the upland slopes of the Middle Applegate Watershed are colluvial movement, deep weathering, and water erosion. Most soils on steep upland slopes of the watershed are developed in colluvium rather than residual material. Loose surface gravel on upland slopes indicate current episodes of colluvial movement. Deep weathering occurs typically on moderately steep base slopes and side slopes where colluvium accumulates. On the typical slope, protected by plant, litter, and duff layer, there is little if any evidence of water erosion. However, where soil is exposed, usually from wildfire, water erosion will occur prior to reestablishment of vegetation. The upland landscape, which is commonly dissected with draws, is indicative of past erosional episodes that formed the draws and related alluvial fans on the valley floor.

Site Productivity

Site productivity is the capability of a soil to produce a specified plant or sequence of plants under specific management (USDA 1993). Productivity of forest lands is largely defined in terms of site quality, which is measured by the maximum timber crop the land can produce in a given time. Site quality within a given microclimate is associated with the soil's capacity to provide moisture and nutrients. Beneficial soil organisms control many biological processes within the soil, such as nitrogen fixation, decomposition, and plant nutrient uptake (Amaranthus 1989). A cool, moist environment encourages the growth and productivity of these soil organisms. Surface duff and woody debris insulate the soil layer and keep soil conditions cool and moist. This is especially important in the Middle Applegate Watershed because generally xeric moisture conditions combined with hot summer temperatures create conditions that are less than desirable for tree growth and thus accumulation of woody debris and duff. Therefore, the depth of surface duff and the abundance of downed woody debris provide a good barometer of site productivity.

Coarse woody debris (downed logs greater than 16 inches in diameter) store moisture during dry periods, enrich soil with mineralized nutrients, store heat, and facilitate many other ecosystem functions. Studies indicate that the Middle Applegate has much lower amounts and smaller sizes of woody debris, especially coarse woody debris, than other regions (Haupt, pers. com. 1995, Sensenig, pers. com. 1995). This is probably due to past high fire frequency and poor growing conditions.

Under forested conditions (hardwoods, conifer poles and larger) duff thickness in lower

Thompson Creek is usually 0.5 inch or less (Haupt, pers. com. 1995). Other sites at higher elevations in the watershed probably have a greater accumulation of duff due to slower decomposition rates. Under predominately brush conditions, the litter is usually 0.25 inch or less with mineral soil exposure more common. Studies indicate that while the duff/litter layer is relatively thin in the Middle Applegate, it's coverage is extensive (McCrimmon and Atzet 1992).

Another factor that affects site productivity is soil density. Tractor logging can compact soils enough to substantially reduce site productivity (Froelich 1979). Areas in the Middle Applegate Watershed where soil compaction is more extensive than other areas are the headwaters of Thompson Creek, Rock Gulch, and Ferris Gulch (Glover and Maurer 1995).

Surface soil erosion due to water substantially reduces site productivity because it interrupts the cycle that produces fertile soils. Human activities, especially roads and off-highway vehicle (OHV) trails, have accelerated surface erosion in the Middle Applegate. No surface erosion inventory exists for the Middle Applegate however, road-induced erosion has been observed in the Ferris Gulch area, Lomas Road near Rock Gulch, and the Forest Creek road system. OHV induced erosion has been observed in the Ferris Gulch, Hinkle Gulch (lower Thompson Creek), China Gulch, Forest Creek, and upper Poorman Creek areas. Within these road and OHV induced erosion areas are localized sites where ruts and improper drainage have caused erosion and sedimentation.

Terrestrial Vegetation

Tree Series/Plant Associations

There are at least 16 plant series in the Klamath Province (Atzet and Martin 1991). Three of these series are found in the Middle Applegate Watershed: Douglas-fir, ponderosa pine, and white oak. Plant associations for the three series are listed in Table 5. The association descriptions can be found in *Preliminary Plant Associations of the Siskiyou Mountain Province* (Atzet and Wheeler 1984).

Table 5. Tree Series/Plant Associations Common to the Middle Applegate Watershed

Douglas-fir Series/Plant Associations	Ponderosa Pine Series/Plant Associations	White Oak Series/Plant Associations
PSME (Douglas-fir)/BENE (dwarf Oregon grape)	PIPO (Ponderosa pine)-PSME (Douglas-fir)	QUGA (Oregon white oak)/CYEC (Hedgehog dogtail)
PSME/RHDI (Poison oak)-BEPI (Piper's Oregon grape)		QUGA/BRCA (California brome)
PSME/RHDI		QUGA/FRVEB (Woods strawberry)
PSME/RHDI/CYGR (Pacific hound's-tongue)		
PSME-PIPO (Ponderosa pine)		
PSME-ABCO (White fir)		
PSME-ABCO-PIPO		
PSME/ABCO-HODI (Creambrush oceanspray)		
PSME-QUGA (Oregon white oak)/RHDI		
PSME/Depauperate		
PSME/CECU (Wedgeleaf ceanothus)		

Vegetation Condition Classes

The vegetation condition classes listed in Table 6 were defined in the *Medford District Watershed Analysis Guidelines* (USDI 1994). These condition classes are at the next lower level of dichotomy from the previously described tree series/plant associations. At this time data is only available for BLM and USFS administered lands and a data gap exists for private lands (Map 7). Percent of land area figures in this section are derived from the Geographic Information System (GIS).

Table 6. Vegetation Condition Classes for BLM and USFS-Administered Land in the Middle Applegate Watershed

Vegetation Condition Class	Percent of Federal Land
Grass, Forb, Herbaceous	3
Shrub, Non-forest Land	5
Hardwood/Woodland	20
Early (0 to 5 years) and Seedling/Sapling (0 to 4.9 inches DBH)	9
Pole (5 to 11 inches DBH)	11
Mid (Large poles, 11 to 21 inches DBH)	26
Mature/Old-Growth (21+ inches DBH)	26

Source: Medford BLM GIS

Landscape Patterns

In the Middle Applegate, vegetation density (plant stems per acre) levels are generally much higher than in the past, especially in conifer forests. Conifer stands in the Middle Applegate seem to be more homogeneous than in the past. Due to fire suppression and past logging, the ponderosa pine, knobcone pine, and incense cedar stands are converting to Douglas-fir, the climax species for the majority of the forested area. Douglas-fir is even encroaching upon the edges of the oak woodlands. White fir is migrating to lower elevations and encroaching upon the Douglas-fir tree series.

All plant species in the Middle Applegate Watershed appear to be adapted to the Klamath Geologic Province. In this area, drought resistance, or a species' capacity to withstand periods of drought, may be important. Ponderosa pine has favorable drought resistance characteristics (Haupt, Moore, and Tong 1995). Ponderosa pine close their stomata at lower water stress levels than Douglas-fir or grand fir, thereby conserving water. More drought resistance data is needed for other plant species of the province.

Ripple (1994) found that historically, 23 percent of the Rogue River Basin was composed of the ponderosa pine forest type. Currently approximately 5 percent of USFS and BLM forest land in the Middle Applegate Watershed is in the ponderosa pine forest type.

In contrast, the acreage of forest land in the Douglas-fir series is probably at a historically high level (67 percent in the Middle Applegate Watershed). Prelogging history indicates 56 percent of the Rogue River Basin was the Douglas-fir forest type. Douglas-fir is more shade tolerant than ponderosa pine and oak species, therefore it has successfully established in pine stands. The overstocked Douglas-fir stands have been competing with old-growth ponderosa pine for soil moisture. It appears as though the old-growth pine trees, and even Douglas-fir, have not been able to obtain enough water for survival because of their large size and are dying out of the overstocked stands.

Stand Development Process

After a stand-replacing disturbance, forest stands progress through four distinct stages: stand initiation, stem exclusion, understory reinitiation, and old-growth (Oliver and Larson 1990). After a disturbance, the stand initiation stage is entered for several years while new individuals and species enter the stand. It may take several decades for a given stand to make the transition from the stand initiation stage to the stem exclusion stage. The stem exclusion stage occurs when the site growing space is fully occupied, preventing new individuals from invading the site, and causing some of the existing ones to die. This stage has the fewest plant species. The understory reinitiation stage is entered when new species and individuals begin to grow in the understory. As the overstory trees die, trees from the forest floor established during the understory reinitiation stage grow slowly into the overstory. When all of the trees which became established after the initial disturbance die, the stand enters the true old-growth condition (Oliver and Larson 1990).

The majority of the natural Douglas-fir timber stands in the watershed are in the stem exclusion stage. These timber stands probably had one to four thousand stems per acre at the stand initiation stage. The stands were never precommercially thinned and they are just now nearing the end of the stem exclusion stage. Shrubs and herbaceous species are present in the understory but there is little natural tree regeneration. Occasional openings exist in the tree canopy layer where pathogens, winds, or insects have killed a tree or trees. In these scattered openings, natural tree regeneration can take place and the stands enter the understory reinitiation stage. Timber stands that were underburned by natural fire are in the same stage.

Forest Ecosystem Disturbance Processes

Fire and wind are natural disturbances in the Middle Applegate Watershed. Forest fires have played a major role in creating the present day landscape pattern, by influencing species composition and soil site productivity. Fire effects include: killing, scarring, or weakening trees; burning the surface organic matter; increasing nitrogen fixation, decomposition, and nutrient availability; opening knobcone pine cones; creating a hospitable environment for seed germination (fire cherry, fireweed, and *Ceanothus*); creating suitable seedbeds (ponderosa pine); and providing open spaces that favor establishment of shade intolerant species (ponderosa pine). Fire suppression since the early 1900s has resulted in overstocked forest stands, allowed Douglas-fir to replace pine species, and possibly delayed the release of nutrients to the soil.

Windstorms in 1880, 1900, and 1962 (LaLande 1995) have also played a major role in shaping the pattern of the Middle Applegate forest landscape. High winds can uproot trees, snap tree branches, or break the main stem. Thinned forest stands are especially susceptible to wind damage because the remaining trees are no longer protected by surrounding trees. Wind caused openings in the forest canopy layer and created growing space for seedlings and other shade-intolerant plants. Winds disperse seeds, and overturned trees create hummocky soil conditions. The hummocks provide suitable microenvironments for natural regeneration.

Forest pathogens play a significant role in altering the vertical forest stand structure and the landscape pattern of the watershed. *Phellinus pini* (red ring rot) is the most common pathogen in Douglas-fir, although it is also found in ponderosa pine. It causes stem rot and subjects the infected trees to wind damage. Infected trees create wildlife habitat for cavity nesters. Trees eventually die, providing new growing space for seedlings (eventually shifting the stand development pattern to the understory reinitiation stage). As a result, the forest landscape pattern becomes more variable and vertical stand structure develops. Another fungus that has the same effect is *Phaelous schweinitzii* (velvet-top). *Armillaria ostoyae, Fomes annosus,* and *Phellinus weirii* are significant root diseases that should be mapped whenever located.

Diaporthe lokoyae (Phomopsis canker) has been found in some conifer plantations in the Hinkle Gulch area, and in oak woodlands. Damage is usually not serious and it is prevalent after one or two years of drought. Presence of *Diaporthe lokoyae* indicates a conifer plantation is experiencing water stress. The fungus may serve to naturally thin overstocked areas. Black stain root disease (*Ceratocystis wageneri*) probably occurs in the Middle Applegate Watershed and could cause tree mortality in 15 to 25-year old plantations.

Bark beetle infestations are becoming more prevalent in the Middle Applegate. Because a beetle species preferentially attacks a particular tree species, beetles are a problem in the commercial stands. Mountain pine beetles (*Dendroctonus ponderosae*), western pine beetles (*Dendroctonus brevicomis*), and pine engraver beetles (*Ips* spp.) attack pines. Flatheaded fir borers (*Melanophila drummondi*) and Douglas-fir beetles (*Dendroctonus pseudotsugae*) infest Douglas-fir. Fir engravers (*Scolytus ventralis*) select white fir.

Because of the drought and high stand stocking levels the trees are severely stressed physiologically. The beetles prefer trees that are stressed by disease, injury, drought, and competition. Beetle populations have been increasing in a large percentage of the commercial timber stands. Large diameter old-growth trees and patches of suppressed younger trees are likely targets for attack. The Goheens (1995) state that whenever stand basal area exceeds 120 square feet per acre on drier sites or 140 square feet per acre on moister sites, the risk of beetle infestation is high. Risk is also high in stands with a south, east, or west aspect below elevations of 3,500 feet. Until the stocking density of the conifer stands is reduced the potential for extreme levels of tree mortality is great. There is a great potential to completely lose the large ponderosa pine and Douglas-fir component of many stands in the next few years. Some timber stands will also die even if thinned within the next few years. In some areas of the Middle Applegate, the future of all ponderosa and sugar pines appears tenuous (Goheen and Goheen 1995).

In the Middle Applegate, animals play a very minor role in changing the landscape pattern and structural diversity of the forest. Deer and rabbit browsing may slow down plant succession in a few isolated areas by keeping the vegetation in an early seral stage. This can give a competitive advantage to distasteful species (whiteleaf manzanita). Grazing by cattle or sheep would have the same effect. Deer can also thin dense patches of saplings by barking (polishing their antlers).

Large fallen trees that reside on the forest floor for long periods adds to spatial, chemical, and biotic diversity of forest soils, and to the processes that maintain long-term forest productivity (Maser et al. 1988). Site productivity in the Middle Applegate Watershed is described in the Soils section.

Acceptable Rate of Forest Growth

Based on an analysis of forest conditions, including tree ring growth, forest growth rates at 41 sampled locations in the Middle Applegate were determined to be in a state of decline (Haupt 1995). Acceptable forest growth is attained when forests grow at a rate that satisfies the desired structural and production characteristics for the specific resource management objectives of the stand. In addition, acceptable rate necessitates that forests are sufficiently resilient and vigorous to sustain these desirable characteristics through time. The desirable forest characteristics, hence the acceptable rate, will vary depending on the management objectives for the specific area.

Observations and data indicate that the forests of the Middle Applegate are predominately lacking resiliency and vigor. A diminished ability to resist potentially damaging forest insects, particularly bark beetles, is characteristic of forests lacking vigor. The ongoing escalation of bark beetle related tree mortality throughout the Middle Applegate is consistent with this premise. The primary factor contributing to diminished forest vigor is the elevated forest density, resulting in excessive competition for resources including water, light, and nutrients (Haupt 1995). Overall, acceptable growth rates are not being attained in the Middle Applegate, nor are they presently on a trajectory for attainment in the foreseeable future.

Plant Communities of Special Importance

Plant communities at risk of extirpation from the watershed or at risk of losing the characteristics of their specific communities are valley bottom communities and low-middle elevation grasslands, including savannahs (USDA and USDI 1994c).

Since the settlement by Euro-Americans, valley bottom plant communities in the Middle Applegate have been dramatically altered. Nearly all natural plant communities within this zone have been severely impacted or almost eliminated by logging and the conversion of valley bottomland to farmland, ranches, urban areas, homesites, and roads. Additional factors that have threatened natural plant communities include mining, water diversions, irrigation, logging, fire suppression, and the introduction of exotic plant species. Natural plant communities affected include grasslands, oak woodlands, oak savannas, shrublands, and conifer forests.

Low-middle elevation grasslands are threatened by invasion and dominance of non-native plant species. Factors contributing to this invasion are livestock grazing, purposeful or unintentional introduction of non-native species, and the ability of these non-native species to spread aggressively after ground disturbance.

Special Status Species

Species limited in abundance and distribution with identifiable threats to their existence are managed by the Bureau as "special status species." Special status plant species refer to plants that are either Federally listed as threatened or endangered, officially proposed for Federal listing as threatened or endangered, or a candidate for Federal listing as threatened or endangered, under the Endangered Species Act. Special status species also include plants listed by Oregon as threatened or endangered (or other such category), or listed by a BLM State Director as sensitive.

Special status vascular plants have been tracked on the Medford District since 1980. In the Middle Applegate Watershed, six species have been found (Table 7). Bordering populations and existing special habitats indicate that approximately 20 additional special status species may occur.

All habitats associated with currently known populations of special status plants have seen a reduction in total area and/or a decline in overall health.

Table 7. Special Status Vascular Plant Species

Species	Status[1]	Habitat Requirement	No. of Sites
Cypripedium fasciculatum	FC2;S&M	open coniferous forest	28
Cypripedium montanum	BTO;S&M	moist areas, dry slopes, mixed-evergreen or coniferous forest	7
Fritillaria gentneri	FC1	dry slopes, open oak woodland, shrubland	3
Mimulus douglasii	BTO	gentle slopes, bare, weathered clay, or granitic soils	3
Sedum laxum ssp. heckneri	BAO	dry rocky places	6
Sedum oblanceolatum	FC2	rocky slopes	2

1/ Status

- FC1 = Federal Candidate, category 1; sufficient information exists to support listing as threatened or endangered, listing is anticipated.
- FC2 = Federal Candidate, category 2; current information indicates listing as threatened or endangered is appropriate but sufficient data not available.
- BAO = Bureau Assessment, Oregon; at minimum, need protection or mitigation in BLM activities.
- BTO = Bureau Tracking, Oregon; not necessarily considered as special status plant for management purposes.
- S&M = Survey and Manage; protected through survey and management standards and guidelines of the ROD.

General regional surveys for fungi, mosses, lichens, and bryophytes are scheduled to be initiated in fiscal year 1996. Surveys for fungi, mosses, lichens, and bryophytes have not yet been conducted and therefore, there are no known populations in the watershed. However, based on the sensitive species plant list for the Medford District, there are potentially 18 species of special status liverworts, 17 species of special status mosses, and 20 species of special status lichens.

All these species should be considered at risk of extirpation from the watershed because they may occur only in rare habitats, their habitats may be threatened, they may be very localized, or their populations may consist of few individuals.

Special Emphasis Species (Noxious Weeds)

Noxious weeds as defined by the Oregon State Weed Board are "[Those plants] which are injurious to public health, agriculture, recreation, wildlife, or any public or private property." Many noxious weeds are introduced species. The rate of spread and establishment of exotic plant species induced the Oregon Department of Agriculture (1995) to declare them a menace to public welfare (ORS 570.505). Unintentional introductions of noxious weeds occur by several modes. Roads and powerlines create corridors into uninvaded areas; humans, animals, or vehicles carry seeds from one area to another; and livestock feeds also introduce seed. Noxious weeds can usually thrive in "disturbed" environments, and once established, they usually compete with and replace native vegetation.

Current Medford District noxious weed policy includes assisting Oregon Department of Agriculture's efforts to control and identify target species, and tracking the distribution and spread of target species on BLM-administered lands. Current research is focused on identifying and monitoring biological control agents.

There are five noxious weed species identified by Oregon Department of Agriculture (1995) known to occur within the Middle Applegate Watershed: *Senecio jacobaea* (tansy ragwort), *Centaurea solstitialis* (yellow star thistle), *Taeniatherum asperum* (medusahead rye), *Hypericum perforatum* (Klamath weed), and *Cirsium vulgare* (bull thistle). Twelve species have been detected within the Applegate River Watershed (USDA and USDI 1995a). Therefore, the list for the Middle Applegate Watershed will likely expand as additional surveys are conducted.

Fire and Air

Fire suppression has allowed fuels, such as downed logs and underbrush, to accumulate in forest stands. Conifer encroachment upon hardwood and brush stands has increased the chance that a brush fire could turn into a stand-replacement fire. The probability of a major, severe (stand-replacement) fire in the Middle Applegate increases yearly.

A high fire hazard area has a high probability of a catastrophic event if a fire occurs during dry conditions. Approximately 20 percent (estimated from 1500 acre Thompson Creek sample) of the Middle Applegate is in this condition. Generally the high fire hazard areas are the upland areas where the fuel loadings are moderate to high and the slopes range from moderate to steep (Map 8). Canyons are particularly dangerous. Canyons are normally areas which contain intermittent streams enclosed by extremely steep side slopes. These areas act like chimneys during wildfire events and increase the probability of a small wildfire becoming catastrophic. The highest fire hazard areas are brush/hardwood stands that are multi-layered and/or have vegetative crowns close to the ground. These stands pose a crown fire threat to adjacent, moderate hazard conifer stands.

A medium fire hazard area will generally develop a mosaic of burned and unburned vegetation if fire is introduced during dry conditions. Approximately 65 percent (estimated from 1500 acre Thompson Creek sample) of the Middle Applegate is in this condition. Stands of over-dense mature trees with some underbrush and ladder fuels are examples of medium fire hazard areas.

A low fire hazard area is likely to result in an underburn, if fire is introduced during dry conditions. Only an estimated 15 percent (estimated from 1500 acre Thompson Creek sample) of the Middle Applegate is in this condition. A stand with large, well spaced, mature trees with little underbrush and minimal ladder fuels would be an example of a low fire hazard area. Irrigated agricultural land would also meet the low hazard definition.

High fire risk areas include major ridges, lands adjacent to roads, powerlines, and private lands. Ridges are susceptible to lightning strikes, off-highway vehicles and other vehicles can ignite dry grass, and damaged powerlines can throw sparks. Arson and improper cigarette disposal are always problems.

The risk to life and property is high in the Middle Applegate Watershed because of high tree and shrub densities with an abundance of fire ladder fuels, moderate to steep slopes, poor vehicle access, high fire hazard areas surrounding structures on private property, and the scarcity of accessible water sources. The human population in the Applegate is highest in the Middle Applegate Watershed. With more and more people moving into forested areas, the risk to life and property from wildfire increases.

It has been documented that the air quality of the Siskiyous has improved significantly since the onset of effective fire suppression and smoke-management of slash burning since the 1960's (LaLande 1995). The majority of the Middle Applegate Watershed lies within a

Special Protection Zone created by the Oregon Smoke Management Plan (Oregon Department of Forestry 1972). Restrictions on prescribed burning apply in this zone.

Wildlife Species and Habitat

The Terrestrial Vegetation section describes the various plant associations and condition classes that constitute the terrestrial wildlife habitats found in the watershed. Refer to that section for a detailed description of these plant associations and condition classes and their relative abundance on BLM-managed lands in the watershed. The described condition classes provide habitat for approximately 235 terrestrial wildlife species that are known or suspected to occur in the Middle Applegate Watershed. Table 8 lists representative wildlife species for the described condition classes.

Table 8. Vegetation Condition Class and Representative Wildlife Species

Condition Class	Representative Species
Grass/Forb/Herbaceous	Gopher snake, western meadowlark, California ground squirrel
Shrub/Non-forest Land	Western fence lizard, wrentit, dusky-footed woodrat
Hardwood/woodland	Ringneck snake, acorn woodpecker, western gray squirrel
Early and Seedling/Sapling	Northwestern garter snake, mountain quail, pocket gopher
Pole (5-11" DBH)	southern alligator lizard, golden-crowned kinglet, porcupine
Mid (11-21" DBH)	Ensatina, Steller's jay, mountain lion
Mature/Old-growth (21+" DBH)	Siskiyou mountains salamander, northern spotted owl, northern flying squirrel

Data are lacking on the relative abundance of the various habitat types on private lands. Based on a 1986 interagency habitat inventory of both federal and private lands (Arnold and Bauer 1986), Table 6, and known land ownership percentage and pattern, an extrapolation of the relative abundance of the various vegetation condition classes (habitat types) for the entire watershed is possible. The extrapolated data are shown in Table 9.

Table 9. Vegetation Condition Classes for All Lands[1] in the Middle Applegate Watershed.

Vegetation Condition Class (Habitat Type)	Percent of Watershed
Grass/Forb/Herbaceous	10
Shrub/Non-forest Land	10
Hardwood/Woodland	15
Early and Seedling/Sapling	15
Pole (5-11" DBH)	20
Mid (Large poles, 11-21" DBH)	20
Mature/Old-Growth (21+" DBH)	10

1/ Based on an extrapolation of the relative abundance of the various vegetation condition classes.

The rather balanced distribution of habitat types is reflected in the number of species present in the watershed. Even though species richness is high, elements of decline are present in all habitat types. Grass/forb/herbaceous habitat is less productive due to the encroachment of noxious species. Snags are inadequate in early, seedling/sapling and pole habitat. As a result of fire suppression, much of the shrub habitat has become decadent, oak-woodlands have become over-dense and mast production has declined, and intra-stand structure in mid-successional habitat is deficient. The abundance of functional mature/old-growth is declining due to timber harvest. Although supportive data are not available, the decline in habitat conditions has not likely resulted in a decrease in species richness, but populations of some species have likely decreased.

Special/Unique Habitats

Talus and mine shafts provide special or unique wildlife habitats in the Middle Applegate Watershed. Talus normally occurs in small pockets and is scattered throughout the watershed. In combination with the proper microclimatic conditions, talus provides important habitat for at least one special status species within the watershed, the Siskiyou Mountains salamander. Salamanders appear to prefer cool, damp, talus areas within timber stands. A habitat affinity study is ongoing in the watershed.

Abandoned mine shafts exist throughout the Middle Applegate Watershed. A variety of wildlife species use mines to fulfill a variety of needs. The most notable group of species using mines for some life function are bats. Five special status bat species are known to use mines within the watershed. Depending on the species, mines are used as day roosts, night roosts, hibernation, or maternity sites. However, mine habitat is transient because over time mines collapse and become unusable due to entrance blockages or microclimatic change.

Special Status Species

Special status species include those species that are listed by the U.S. Fish and Wildlife Service as threatened or endangered, proposed for listing as threatened or endangered (category 1), or a candidate for listing as threatened or endangered (category 2) under the auspices of the Endangered Species Act of 1973, as amended. Species that are listed by the BLM as sensitive or assessment species are also designated as special status species. Species designated in the Northwest Forest Plan as Survey and Manage species and those designated to receive Protection Buffers are also addressed in this section.

Twenty-three special status species are known or suspected to be present in the Middle Applegate Watershed. Table 10 lists these species, their status, and the primary reason they are listed as special status species. Additional information on special status species can be found in the Wildlife Report (Arnold 1995).

Table 10. Special Status Wildlife Species Found in the Middle Applegate Watershed

Species	Status[1]	Primary Reason(s) for Status
Western Pond Turtle (*Clemmys marmaorata*)	C2	Habitat loss/degradation, predation
Tailed Frog (*Ascaphus truei*)	C2	Timber harvest, water quality degradation
Siskiyou Mountains Salamander (*Plethodon stormi*)	C2	Limited range, timber harvest
Foothill Yellow-legged Frog (*Rana boylii*)	C2	Population decline (unknown reasons)
California Mountain Kingsnake (*Lampropeltis zonata*)	BA	General rarity
Common Kingsnake (*Lampropeltis getultus*)	BA	General rarity
Northern Spotted Owl (*Strix occidentalis caurina*)	T	Timber harvest
Bald Eagle (*Hailaeetus leucocephalus*)	T	Shooting, pesticides, disturbance
Northern Goshawk (*Accipiter gentilis*)	C2	Timber harvest
Great Gray Owl (*Strix nebulosa*)	BS	Timber harvest

Species	Status[1]	Primary Reason(s) for Status
Pileated Woodpecker (*Dryocopus pileatus*)	BA	Timber harvest
Lewis' Woodpecker (*Asyndesmus lewis*)	BA	Timber harvest, fire suppression, and rural/urban development
Flammulated Owl (*Otus flammeolus*)	BA	Timber harvest
Northern Saw-whet Owl (*Aegolius acadicus*)	BA	Timber harvest
Western Meadowlark (*Sturnella neglecta*)	BA	Development (residential and commercial)
Western Bluebird (*Sialia mexicana*)	BA	Development
Fisher (*Martes pennanti*)	C2	Timber harvest
Townsend's Big-eared Bat (*Plecotus townsendii*)	C2	General rarity and lack of information.
Fringed Myotis (*Myotis thysanodes*)	C2	General rarity and lack of information.
Long-eared Myotis (*Myotis evotis*)	C2	General rarity, lack of information, timber harvest
Yuma Myotis (*Myotis yumanensis*)	C2	General rarity, lack of information
Long-legged Myotis (*Myotis volans*)	C2	General rarity, lack of information, timber harvest
American Marten (*Martes americana*)	BA	Timber harvest
Red Tree Vole (*Arborimus longicaudus*)	SM	Timber harvest

1/ Status

T - Listed as threatened under the ESA
C2 - Candidate for listing as threatened or endangered, Category 2.
BS - Bureau sensitive
BA - Bureau assessment
PB - Designated to receive protection buffers in the ROD
SM - Designated as a Survey and Manage species in the ROD

Spotted owl habitat is shown on Map 9. With the exception of the northern spotted owl, basic inventory and monitoring data are needed to assess distribution, habitat condition, and population status for these species. This lack of data is an identified data gap.

Linkage/Dispersal

One of the most striking landscape characteristics of the watershed is the vegetative contrast of the southerly/westerly aspects and the northerly/easterly aspects. From Forest Creek northwest to Slagle Creek in the Applegate Valley, the contrast is especially apparent.

Southerly/westerly aspects are dominated by grass/forb/herbaceous, shrub, and hardwood/woodland condition classes. Northerly/easterly aspects are dominated by the Douglas-fir series with the associated condition classes, i.e., early and seedling/saplings, poles, mid, and mature/old-growth.

This north/east-south/west dichotomy is a result of geologic, soil, and environmental conditions, and presents a potential obstacle for linkage/dispersal within the watershed for some of the less mobile forest dwelling species. Dispersal may be most difficult for animals dispersing from the north facing forested areas of the Rogue Valley, and from Forest Creek to the Applegate Valley, and vice versa. "Stringers" of forestland in some of the drainage areas on the south and west facing slopes allow the less mobile species to move in and out of the Middle Applegate within preferred habitat rather than forcing them into the more inhospitable habitats characteristic of the south facing slopes. This situation is also true for dispersal to and from the Williams Creek drainage, but to a lesser extent because the grassland/shrubland complex is not as extensive.

Residential areas in the valley, irrigation ditches, and the Applegate River and associated floodplain are major deterrents to further dispersal for the less mobile species in the Middle Applegate. For some species that may be totally blocked from further dispersal in the watershed by these factors, the headwaters of the watersheds to the southeast (e.g., Little Applegate and Upper Applegate) where these obstacles don't occur are important in overall dispersal in the entire Applegate Subbasin.

AQUATIC COMPONENTS

Aquatic components discussed in this section include upland condition, ground water, water bodies (wetlands, reservoirs, ditches, and streams), water quantity, water quality, riparian vegetation and habitat, and fish.

Upland Condition

The Middle Applegate Watershed has been stratified into five subwatersheds (Map 10) to evaluate upland conditions. Area and percent ownership by subwatershed are displayed in

Table 11. Elevation range varies by subwatershed from a 2,925 foot difference in Ferris/Slagle to a 3,800 foot difference in Thompson Creek (Lindell 1995). The highest point in the Middle Applegate is Humpy Mountain (5,054 feet).

Table 11. Ownership by Subwatershed

Subwatershed	Area (acres)	Area (sq. mi.)	Ownership (percent)			
			BLM	USFS	State	Private
Ferris/Slagle	12,101	18.9	42	0	2	56
Forest Creek	22,521	35.2	49	0	0	51
Humbug/Chapman	22,394	35.0	63	0	<.1	37
Spencer/Rock	6,542	10.2	62	0	0	38
Thompson Creek	20,027	31.3	65	10	0	25
Totals (Middle Applegate)	83,585	130.6	56.6	2.5	.2	40.7

Source: Medford BLM GIS data

Upland conditions that affect erosional or hydrologic processes can have substantial detrimental impacts on aquatic systems. Colluvial movement, deep weathering, and water erosion are the predominant hillslope erosional processes occurring naturally in the Middle Applegate Watershed. Natural disturbances, such as wildfires and flooding, and human-caused disturbances, such as timber harvest and road construction, can accelerate the erosional processes.

Hydrologic processes include interception, transpiration, infiltration, subsurface flow, and streamflow. Increased sedimentation, disruption of subsurface flow, reduced infiltration rate, increased magnitude and frequency of peak flows, and reduced base flow are potential effects that can occur as a result of changes in upslope vegetation and soil conditions. Timber harvest, road building, and soil compaction are the primary upslope disturbances affecting hydrological processes in the Middle Applegate Watershed. The affects of these human-caused disturbances on hydrological processes are discussed later in the Water Quantity and Quality sections.

Vegetation removal temporarily reduces interception and transpiration, and allows more precipitation to reach the soil surface and drain into streams or become ground water. Conversely, densely vegetated areas have high interception and transpiration rates, thereby decreasing the amount of moisture reaching surface and ground water bodies. Distribution of vegetation condition classes provides some insight as to vegetative cover and hydrologic response. Acres of vegetation by condition class are available for BLM and Forest Service-administered lands, however, no information exists for acres by vegetation condition class for non-federal lands (Lindell 1995). None of the subwatersheds have large areas of recent vegetation removal on federal lands. A high percentage (40 to 62 percent) of federal land contains the larger mid and mature/old-growth classes, with Thompson Creek Subwatershed having the largest amount (Map 7).

The Middle Applegate Watershed has a low percentage (eight percent) of land in the transient snow zone, most of which is in the Thompson Creek Subwatershed (Lindell 1995). The majority of the transient snow zone vegetation is in the pole, mid, and mature/old-growth classes.

Satellite imagery data for the Applegate was used to depict canopy closure on all lands in the Middle Applegate Watershed (Map 11). Ferris/Slagle and Spencer/Rock subwatersheds have less vegetative cover than the other subwatersheds and Thompson Creek Subwatershed has the largest amount of vegetative cover (Lindell 1995).

Roads and soil compaction due to yarding (especially with tractors) reduce infiltration, accelerate erosion, and change the surface and subsurface flow network. Proximity of roads and compacted areas to water bodies influences the magnitude of the impact. Soil compaction data from yarding activities has not been compiled for the Middle Applegate subwatersheds. Map 12 gives a visual portrayal of road densities for all ownerships. Highest road densities are found in Forest Creek (5.3 mi/mi^2) and Spencer/Rock (4.7 mi/mi^2) subwatersheds. Stream crossing density (number of stream crossings per square mile) is highest in Forest Creek (61.6/mi^2) and Humbug/Chapman (42.8/mi^2) subwatersheds. Forest Creek and Humbug/Chapman subwatersheds have the largest number of stream crossings per stream mile, 7.2 and 5.4 respectively. Road densities, stream crossing densities, and the number of stream crossings per stream mile by stream order are in the Hydrology Report (Lindell 1995).

Ground Water

Ground water supplies in the Middle Applegate Watershed are limited and primarily found in valley bottom alluvium (Glover and Maurer 1995). This area has not been identified as a critical ground water area by the Oregon Water Resources Department (OWRD 1989). Baseline information to assess the current status of ground water quantity or quality is not available. Recent years of below normal precipitation (Climate section) have resulted in reduced recharge of ground water supplies. The number of water rights issued for ground water in the Middle Applegate has been on the rise since the 1970's (OWRD 1995) as the rural population density increases. Water rights for ground water in the Middle Applegate are solely for irrigation use. Allocation rates are shown in Table 12. Ground water uses exempt from water rights include: stock watering, lawn or non-commercial garden watering of no more than 0.5 acres, and single or group domestic purposes for no more than 15,000 gallons per day. No information is available regarding the amount of exempt uses.

Water Bodies

Water bodies in the Middle Applegate Watershed include wetlands, reservoirs, ditches, and streams. Middle Applegate wetlands identified by the U.S. Fish and Wildlife Service in their National Wetlands Inventory (Lindell 1995) are classified as riverine or palustrine (marsh). Wetlands in the National Wetlands Inventory were large enough to be seen on aerial photographs. Additional wetlands may be located during site-specific project analysis. A complete wetland inventory in the Middle Applegate Watershed is lacking. Reservoirs and ditches are shown on Map 10.

There are approximately 986 stream miles in the Middle Applegate Watershed (Map 10). These include 46 miles of fish-bearing streams, and approximately 940 miles of permanently flowing nonfish-bearing and intermittent streams. No inventory of nonfish-bearing streams has been conducted to determine whether they are permanently flowing or intermittent. Miles of stream by stream order, for each subwatershed, are provided in the Hydrology Report (Lindell 1995).

Rosgen's (1994) stream classification system was used to display morphological stream characteristics for the major drainages on Map 13. General stream type categories (A, Aa+, B, C, etc.) are based on stream gradients, sinuosities, valley form, entrenchment, and confinement. These stream characteristics were obtained from 7.5 minute USGS topographic maps and aerial photographs (Lindell 1995). Determination of specific stream types within each general category is unknown and requires a field inventory to identify dominant channel materials.

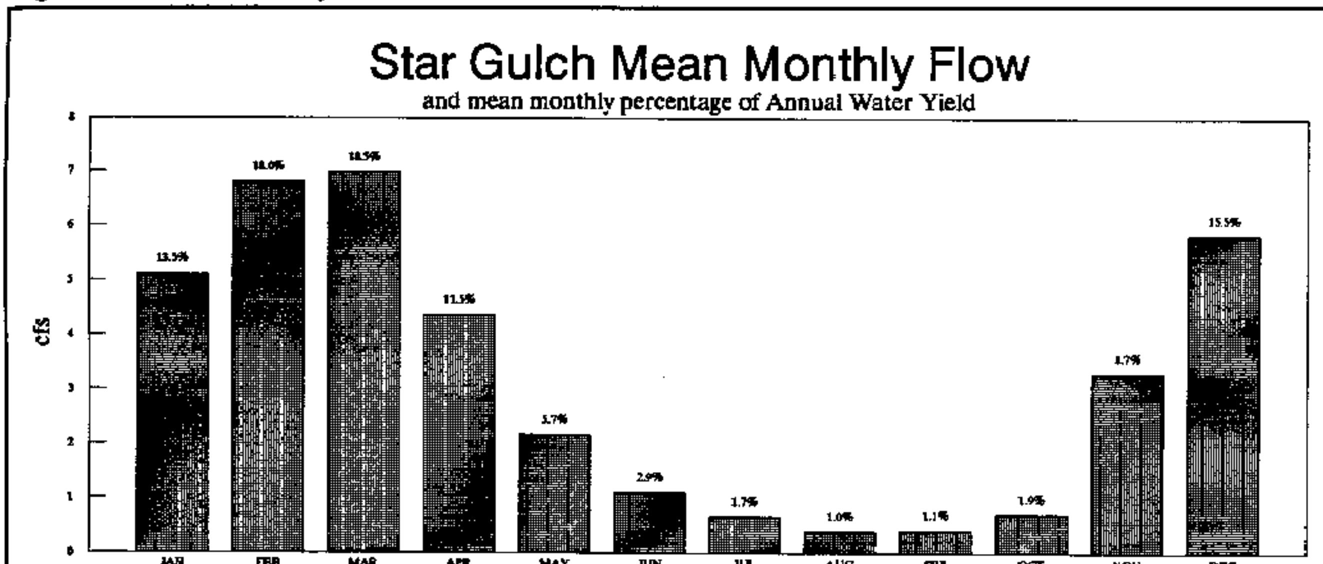
The Rosgen classification system indicates that stream reaches typed as D or G are unstable. Reaches classified as D or G in the Middle Applegate include the lower reach of Ferris Gulch, lower reach of Slagle Creek, main stem of Humbug Creek between Left Fork and Kane Creek, and main stem of Forest Creek between Bishop Creek and Right Fork. A stream inventory is needed to identify channel stability and condition in these reaches.

Most streams on federal lands are located in the upper reaches and are classified as type A or Aa+. The type A streams are steep (4-10 percent), entrenched, step/pool streams. The Aa+ streams are very steep (>10 percent), straight, and deeply entrenched. Stream type identification and description for other stream reaches are described in the Hydrology Report (Lindell 1995).

Water Quantity

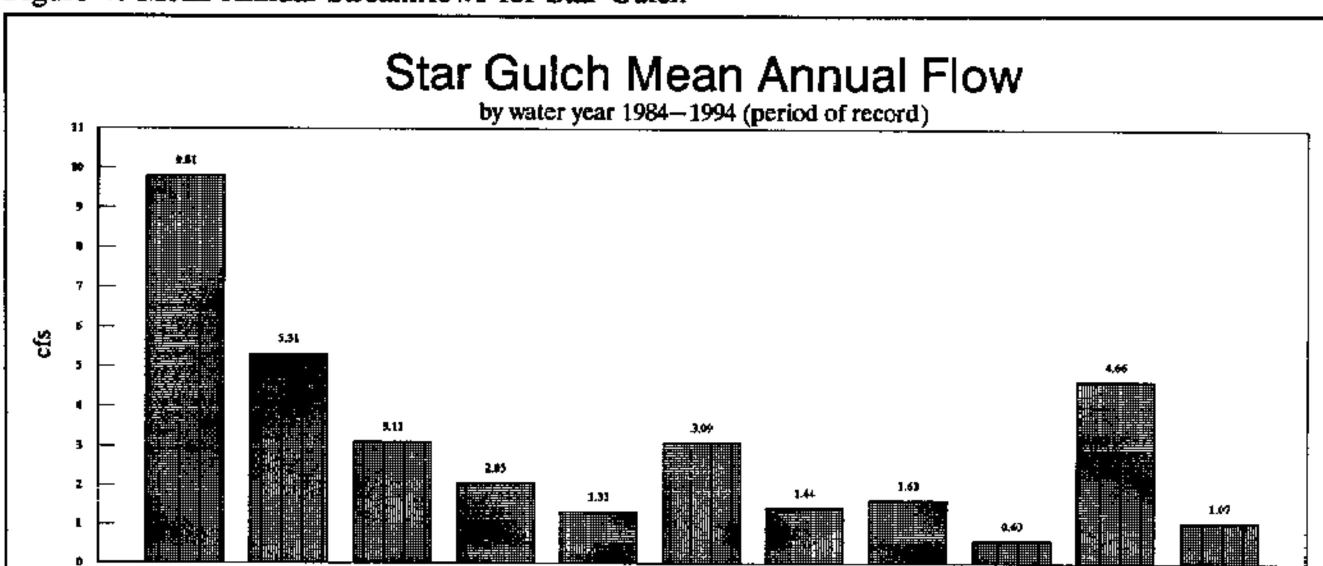
Streamflow in the Middle Applegate Watershed fluctuates with seasonal variation in precipitation. The Star Gulch USGS gaging station provides the nearest non-regulated streamflow information for the Middle Applegate Watershed. Hydrographs were developed for Star Gulch to portray the average streamflow distribution by month and by year for tributaries in the Middle Applegate Watershed (Figures 3 and 4). From the Star Gulch hydrographs, it is estimated that 80 to 90 percent of the annual water yield occurs from November through April in the Applegate River tributaries. Runoff usually peaks in February and March. The lowest streamflows generally occur in August and September.

Figure 3. Mean Monthly Streamflows for Star Gulch



Data July 1983 – September 1994, from USGS Water Resource Data Oregon annual reports.

Figure 4. Mean Annual Streamflows for Star Gulch



Water year October–September. Flow data from USGS Water Resource Data Oregon annual reports.

The annual maximum daily mean flows at Star Gulch range from 4.2 to 139 cubic feet per second (cfs) for the years 1984 to 1994 (Lindell 1995). The annual minimum daily mean flows at Star Gulch range from 0 to 1.6 cfs for the years 1983 to 1994 (Lindell 1995). This wide range in flows is patterned after the widely fluctuating annual precipitation.

Mean monthly streamflows were also obtained from USGS records for the Applegate River near Applegate (Figure 5). Prior to the Applegate Reservoir, nearly 90 percent of the annual water yield for the Applegate River near Applegate occurred from November through May. Upon completion of the Applegate Reservoir, approximately 75 percent of the annual water yield in the Applegate River occurs from November through May. The rest is slowly released throughout the summer. Mean annual flows for the Applegate River gaging station near Applegate are shown in Figure 6. The annual maximum and minimum daily mean flows are displayed in the Hydrology Report (Lindell 1995).

Figure 5. Mean Monthly Streamflows for Applegate River near Applegate

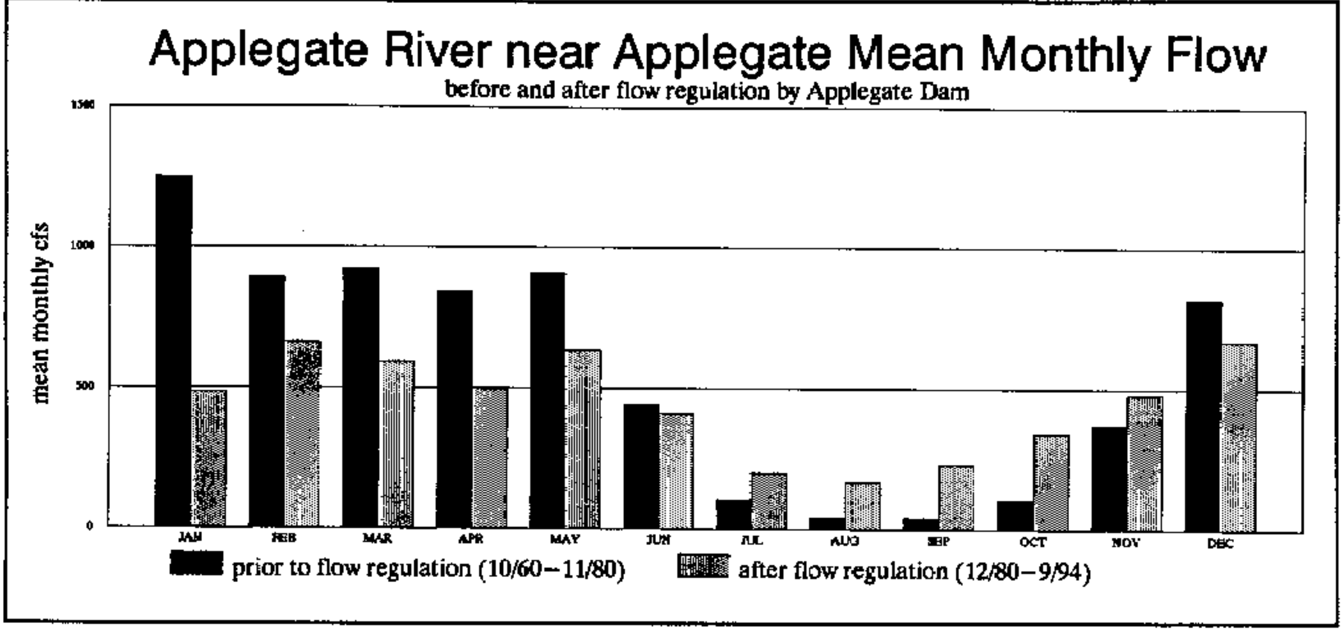
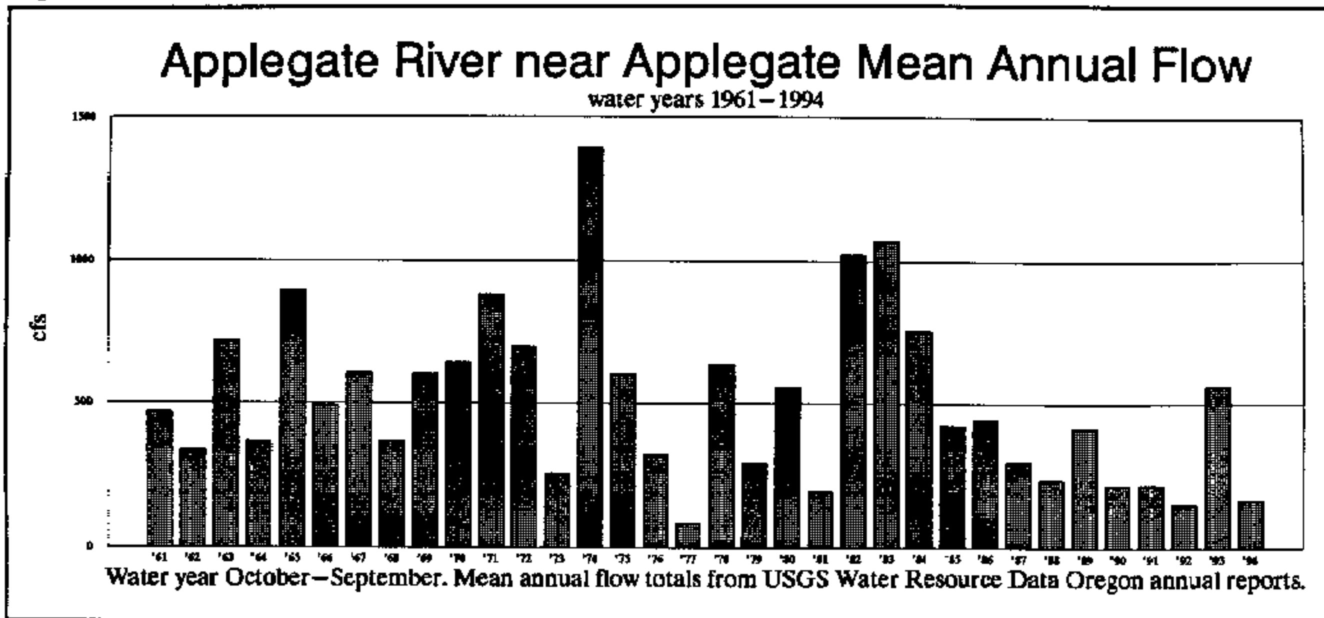


Figure 6. Mean Annual Streamflows for Applegate River near Applegate



Rogue River Basin Program findings (OWRD 1989) pertinent to the Middle Applegate Watershed are listed in the Hydrology Report (Lindell 1995). Conclusions reached in this document include the following.

- Flows during the summer months are inadequate in many areas to satisfy existing needs.
- During the summer months sections of many tributaries are dry or nearly dry.
- The mainstem Applegate River below Applegate Dam and certain reaches of Forest Creek and Thompson Creek are important to protect, maintain, and perpetuate anadromous fish habitat and propagation in the Applegate system.
- Low flows and high water temperatures during the summer months in some sections of tributary streams limit fish production.

Minimum perennial streamflows were established for Thompson Creek at the mouth and the Applegate River near Applegate (Lindell 1995).

Natural and Human Disturbances Affecting Water Quantity

Winter storms have historically brought the most devastating floods to the streamcourses of southwestern Oregon. The most severe floods took place in 1853, 1861, 1890, 1927, 1948, 1955, 1964, and 1974. These historic extremes have generally come in December and January as a result of rain-on-snow storm events (LaLande 1995).

In the Middle Applegate, the primary human disturbances that can potentially affect the timing and magnitude of peak flows include roads, soil compaction due to logging and grazing, and vegetation removal (timber harvest and conversion of sites to agriculture use). Roads collect surface water from the road surface and subsurface water intercepted by roadcuts, and transport this water quickly to streams (Wemple 1994). This generally results in increases in the magnitude of peak flows and alters the timing when runoff enters a stream. This effect is more pronounced in areas with high road densities and where roads are in close proximity to streams (Lindell 1995). Soil compaction resulting from yarding corridors, agriculture, and grazing also affects the hydrology within a watershed by reducing the infiltration rate and causing more rainfall to quickly become surface runoff instead of moving slowly through the soil to stream channels (Brown 1983). Vegetation removal increases the amount of water available to the streams. Large amounts of vegetation removal in the transient snow zone can alter the streamflow regime and result in increased peak flow magnitudes (Christner and Harr 1982). This effect is minimal in the Middle Applegate due to the low percentage of land in the transient snow zone (Lindell 1995). The combined affects of these disturbances on streamflows in the Middle Applegate Watershed are unknown.

Summer streamflows reflect the low summer rainfall (Figures 3 and 5). Naturally low summer flows are exacerbated by the recent period of below normal precipitation (Climate section). Many perennial, tributary streams in the Middle Applegate Watershed have been drying up during the summer. Human disturbances such as water withdrawals (both surface water and ground water) for agriculture and domestic use have a significant impact on the low flows in the Middle Applegate. The combined result of below normal precipitation and water withdrawals is seriously depleted streamflows, which subsequently affect instream fish habitat. Dense young forest stands are another factor which may be contributing to low summer flows due to the large amounts water utilized for transpiration.

The Applegate Reservoir, completed in 1980, has moderated both high and low flows in the mainstem. There are fewer and smaller peak flows and also fewer extreme low flow conditions (Figures 7 and 8). Releases of stored water from the reservoir have prevented the river from drying up completely.

Figure 7. Annual Maximum of Daily Mean Flows for Applegate River near Applegate

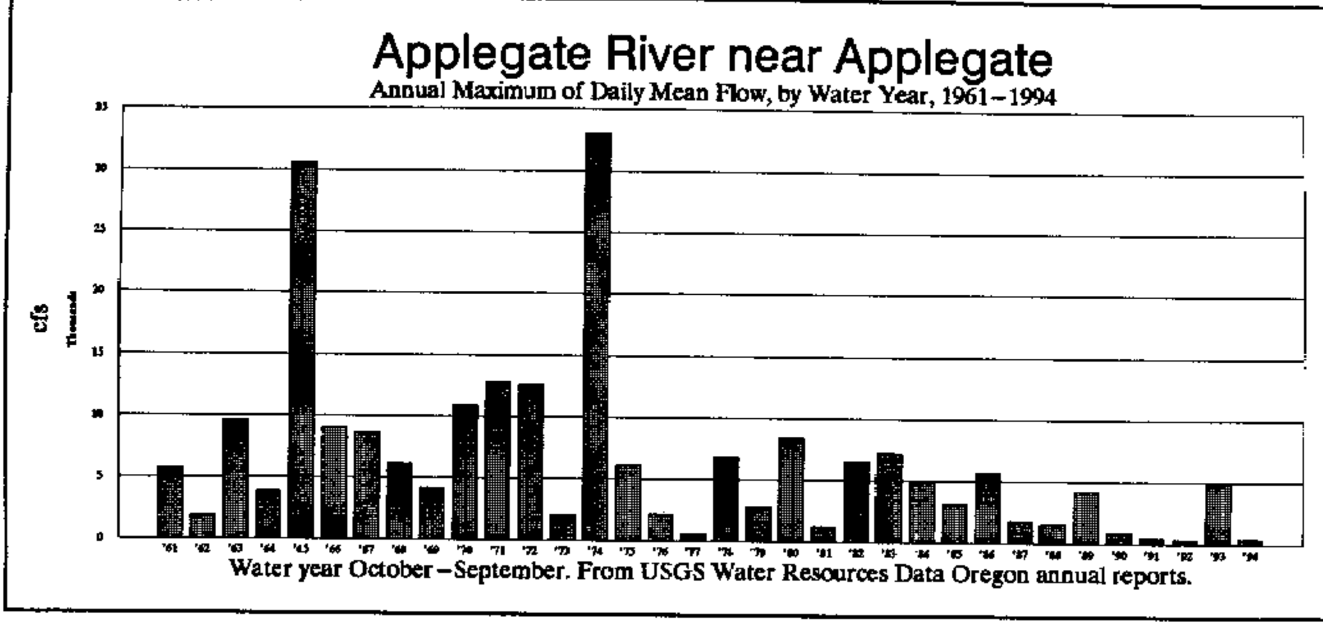
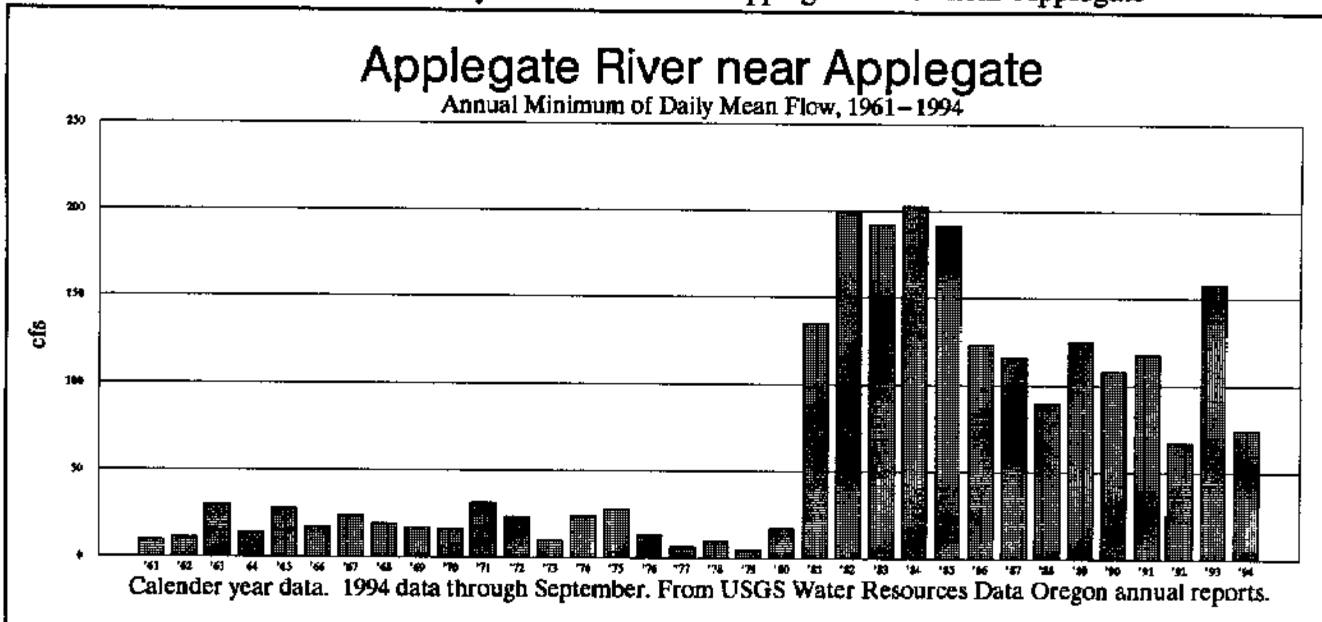


Figure 8. Annual Minimum of Daily Mean Flows for Applegate River near Applegate



Water Use

Greatest need for water occurs during the summer when demand is high for irrigation, recreation, and domestic use. Summer is also the time of lowest yield from the watershed. If it were not for water releases from the Applegate Reservoir, the mouth of the Applegate River would often be dry during the summer.

Table 12 summarizes water right information obtained from the Oregon Water Resources Department (OWRD 1995).

Table 12. Water Rights in the Middle Applegate Watershed

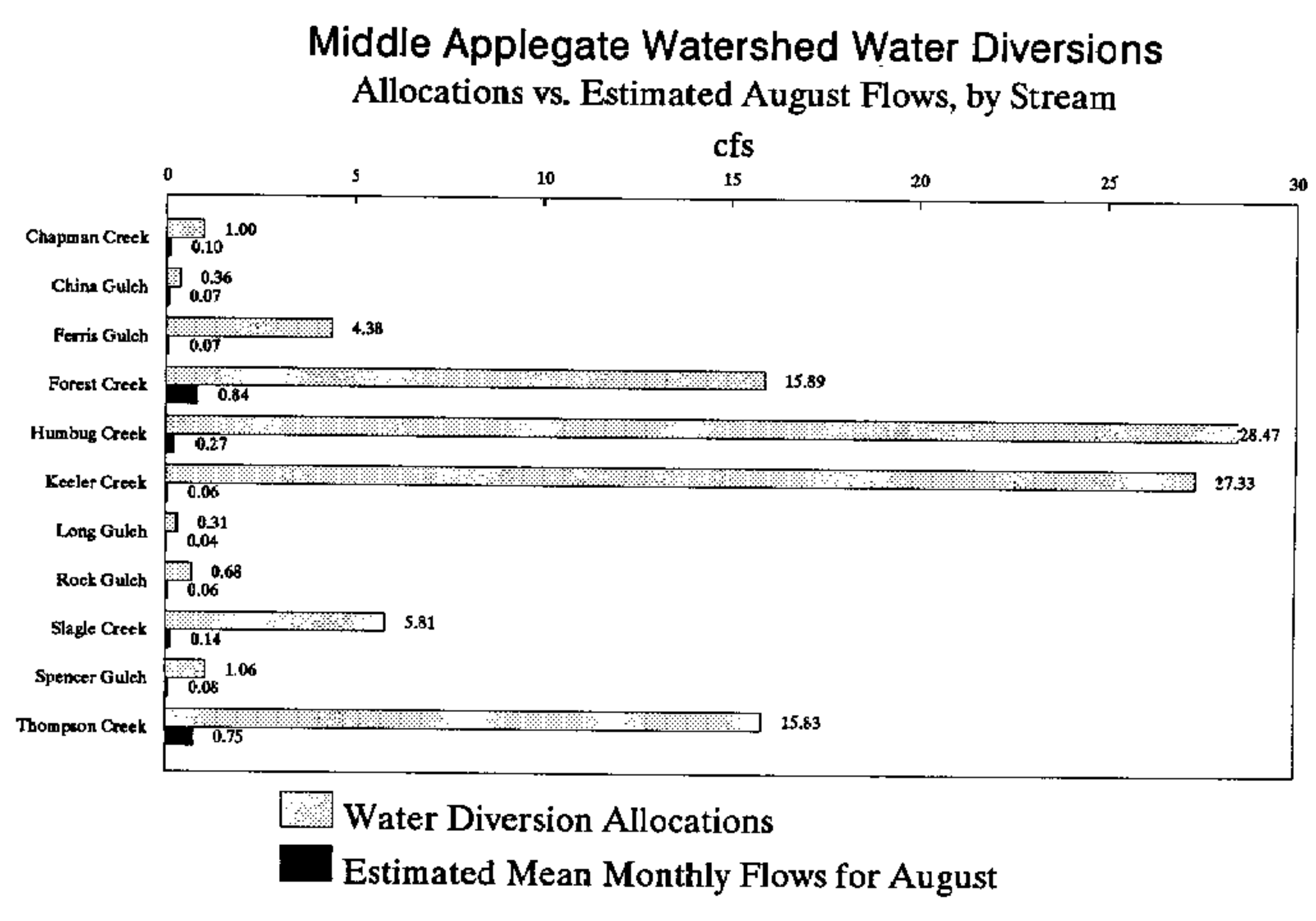
Stream	Oldest Priority Date	Uses and Percent of Total Allocation	Allocation Rates (cfs)		
			Surface Water	Ground -water	Total
Applegate River	12/31/1858	mining (11.78%), irrigation (86.83%), domestic (.01%), livestock (.01%), temperature control (1.36%)	80.65	0	80.65
Chapman Creek	2/17/1955	irrigation (100%)	1.00	0	1.00
China Gulch	12/31/1930	irrigation (100%)	0.05	0.31	0.36
Ferris Gulch	11/16/1938	mining (91.10%), irrigation (7.76%), livestock (.46%), fish (.46%)	4.38	0	4.38
Forest Creek	12/31/1880	mining (66.02%), irrigation (32.98%), domestic (.41%), livestock (.06%), power (.50%)	14.18	1.71	15.89
Humbug Creek	12/31/1866	mining (88.06%), irrigation (11.70%), domestic (.19%)	27.69	0.78	28.47
Keeler Creek	12/31/1890	mining (98.79%), irrigation (1.17%), domestic (.04%)	27.33	0	27.33
Long Gulch	2/20/1929	irrigation (71%), domestic (29%)	0.28	0.03	0.31
Rock Gulch	12/31/1864	irrigation (98.5%), domestic (1.5%)	0.68	0	0.68
Slagle Creek	12/31/1884	irrigation (100%)	1.37	4.44	5.81
Spencer Gulch	8/9/1944	irrigation (100%)	0.67	0.39	1.06

Stream	Oldest Priority Date	Uses and Percent of Total Allocation	Allocation Rates (cfs)		
			Surface Water	Ground -water	Total
Thompson Creek	12/31/1868	mining (.57%), irrigation (98%), domestic (.92%), industrial manuf.(.25%), fire protection (.25%)	11.95	3.88	15.83

Source: Oregon Water Resources Department (1995)

Mean monthly flows for major Applegate River tributaries within the Middle Applegate Watershed were estimated using USGS streamflow data from the Star Gulch gage. Figure 9 compares estimated mean monthly flows for August to the total water right allocations for each stream listed in Table 12. This figure shows the dramatic disparity between low summer streamflows and water allocation rates.

Figure 9. Comparison of Estimated Mean August Flows to Total Water Right Allocations



Water Quality

Water quality in the Middle Applegate Watershed is to be managed to protect the following recognized beneficial uses: domestic water supply, municipal water supply, industrial water supply, irrigation, livestock watering, cold water fish, other aquatic life, wildlife, recreation, aesthetics, and power development (ODEQ 1992). The Oregon Department of Environmental Quality's (DEQ) 1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution identifies four streams in the Middle Applegate Watershed impacted by nonpoint source pollution (Table 13). The major beneficial resources impacted in these four streams are: cold water fish, other aquatic life, and aesthetic quality.

Table 13. Impacted Beneficial Uses in the Middle Applegate Watershed

Stream Name	Impacted Beneficial Uses				
	Livestock Watering	Cold Water Fish	Other Aquatic Life	Wildlife	Aesthetic Quality
Applegate River		X			X
Forest Creek	X	X	X	X	X
Thompson Creek		X	X		X
Ninemile Creek		X			

Source: ODEQ 1988

In these four streams, water quality problems identified by DEQ in their 1988 nonpoint source assessment report include turbidity/sedimentation, low dissolved oxygen, nutrients, low flows, and insufficient stream structure. The severity of nonpoint source pollution is greatest in Forest Creek. Information used by DEQ for the streams in the Middle Applegate was based solely on observations, with no data. No streams in the Middle Applegate Watershed have been designated by DEQ as being water quality limited.

High stream temperatures are not listed in the DEQ report, due to lack of data (Ades 1995). However, elevated water temperatures are of concern for some streams within the watershed (OWRD 1989). In 1994, the USGS collected summer stream temperature data for the Applegate River near Applegate (USGS 1994). From this data the maximum 7-day average high temperature was determined to be 74.4°F. Also in 1994, the Medford BLM obtained summer stream temperature data for Ninemile Creek, Thompson Creek above Ninemile Creek, and Rock Gulch above Lomas Road. Calculated maximum 7-day average high temperatures were 59.8°F, 57.7°F, and 61.5°F, respectively. The Thompson Creek site dried up toward the end of July. A more detailed discussion is provided in the Hydrology Report (Lindell 1995).

Processes and Disturbances Affecting Water Quality

Probable causes (disturbances and alterations) associated with the water quality problems identified for the Middle Applegate in DEQ's 1988 assessment include vegetation removal, surface erosion, water withdrawals, and channel alterations. Associated land uses include irrigated cropland/pastureland, grazing, forestry, mining, and residential construction. Additional information on probable causes and associated land uses can be found in the Hydrology Report (Lindell 1995).

Sedimentation/Turbidity

Sedimentation is the natural process of fine sediments, such as sand and silt, entering a stream channel. However, an excess of fine sediments can cause problems such as turbidity, the presence of suspended solids, or embeddedness, buried gravels and cobbles. Sedimentation is generally associated with storm runoff and is highest during fall and winter. Most of the sediment generated in headwater streams is transported out of the steep tributary channels and into the lower gradient main channels where it is deposited. Natural processes occurring in the Middle Applegate Watershed such as surface erosion, wildfire, and flood events contribute to increased sedimentation.

Accelerated rates of upland erosion, primarily caused by logging and road building, have resulted in excessive sedimentation in the mainstem Applegate River and its tributaries in the Middle Applegate Watershed. Older roads with poor locations, inadequate drainage control and maintenance, and no surfacing are more likely to erode and cause the sedimentation of stream habitats. Road related erosion in the Middle Applegate has been noted in Ferris Gulch, Rock Gulch (Lomas Road), and Forest Creek.

Off-highway vehicle (OHV) use occurs throughout the Middle Applegate Watershed and has been observed to contribute to erosion and increased sedimentation. Erosion from extensive OHV use is of particular concern in Ferris Gulch, Hinkle Gulch (in lower Thompson Creek), China Gulch, Forest Creek, and upper Poorman Creek.

At the lower elevations, increased sedimentation can be attributed to grazing in riparian zones, over-grazing in general, and residential clearing (USDA and USDI 1995a). Streambank erosion is accelerated by riparian vegetation removal. Annual maintenance of many diversion structures (especially push-up gravel dams) and irrigation return flows also cause sedimentation (Applegate River Watershed Council 1994).

Dissolved Oxygen

No dissolved oxygen data exists for the Middle Applegate Watershed. Dissolved oxygen concentrations are primarily related to water temperature. When water temperatures increase, oxygen concentrations decrease. Most likely, the low dissolved oxygen recorded in the DEQ nonpoint source assessment report is a consequence of high stream temperatures (USDA and USDI 1995b).

Nutrients

Nutrient information is not available for the Middle Applegate Watershed. In the Little Applegate Watershed, limited water monitoring for nutrients during 1994 identified an increase in phosphorus concentrations coinciding with human habitation in the lower reaches of the watershed. A possible scenario surmised for the Little Applegate is that orthophosphates applied to agricultural or residential cultivated land as fertilizers may enter the surface waters by irrigation return flows (USDA and USDI 1995b). This same phenomenon is likely to be found in the Middle Applegate Watershed.

Low Flows

Processes and disturbances contributing to low flows are described in the preceding Water Quantity section.

Insufficient Stream Structure

Processes and disturbance contributing to insufficient stream structure are described in the Riparian Habitat section.

Stream Temperature

Many factors contribute to elevated stream temperatures in the Middle Applegate Watershed. Low summer streamflows combined with hot summer air temperatures result in stream temperatures that can stress aquatic life. Low gradient valley bottoms, lack of riparian vegetation, and high channel width-to-depth ratios are additional conditions found in the Middle Applegate that are conducive to high stream temperatures. Natural disturbances that can affect stream temperature in the Middle Applegate are climate (high air temperatures), below normal precipitation (low flows), wildfires (loss of riparian vegetation), and floods (loss of riparian vegetation). Human disturbances affecting stream temperatures in the Middle Applegate include water withdrawals, channel alterations, and removal of riparian vegetation through logging, grazing, or residential clearing.

Summer water temperatures in the mainstem of the Applegate River are noticeably lower since construction of the Applegate Dam. Figures 10 and 11 show the relationship between maximum stream temperatures and streamflows before and after completion of Applegate Reservoir.

Figure 10. Annual 7-day Average Maximum Stream Temperatures for Applegate River near Applegate

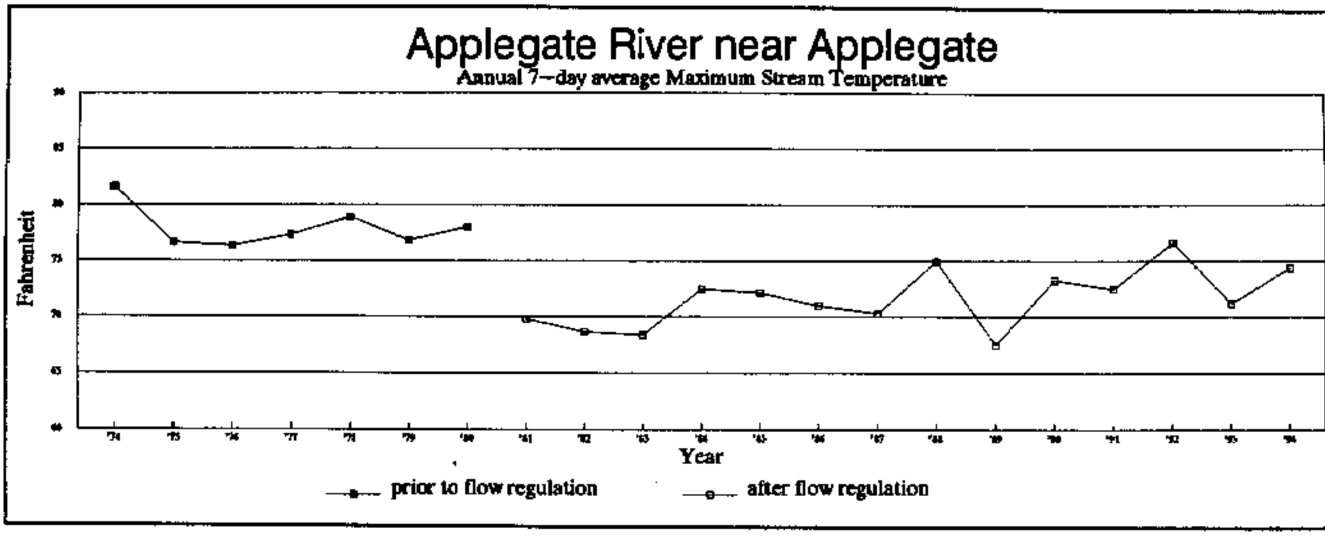
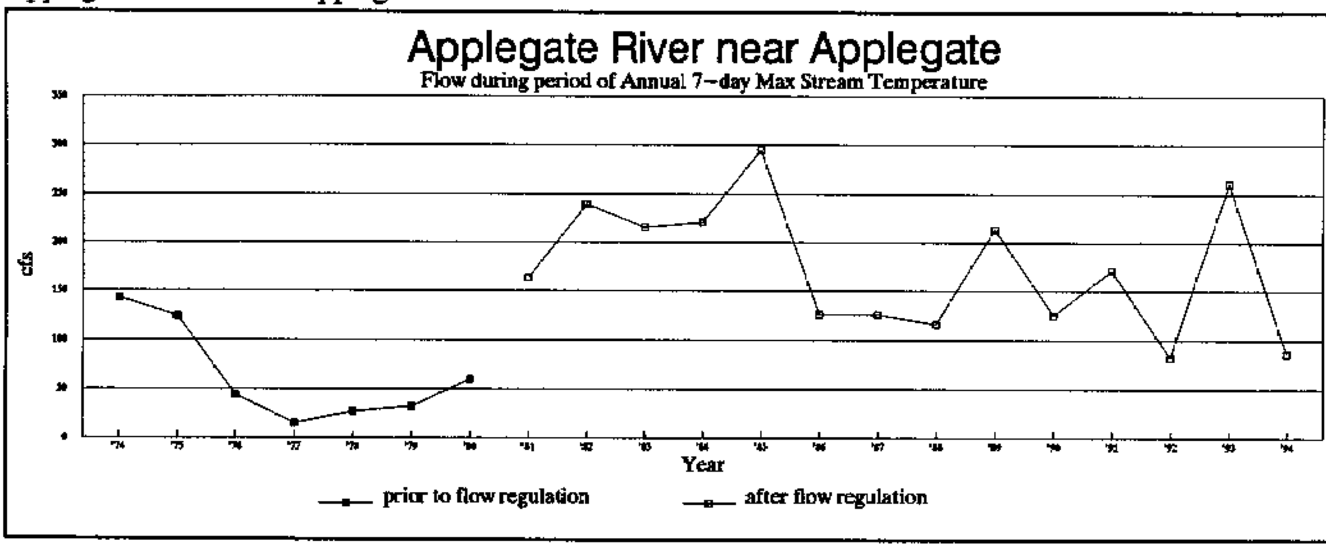


Figure 11. Streamflow During Period of Annual 7-day Maximum Stream Temperatures for Applegate River near Applegate



Riparian Vegetation and Habitat

Riparian zones are the site of critical physical and biological functions and processes. Riparian vegetation contributes woody debris, provides streambank stability, regulates water temperature through shading, creates wildlife habitat and travel corridors, adds nutrients to the stream, slows flood discharges, shades the water surface, and provides critical habitat for adult aquatic insects (Gregory et al. 1991, Allan and Flecher 1993). Groundwater and subsurface stream water is filtered and stored, recharging aquifers (USDI 1994b). Floodplains dissipate flood energy, facilitating the deposition of nutrient-rich soils. Channel geomorphology and riparian vegetation interact to create complex stream habitat for fish and other aquatic organisms with the proper balance of scoured and depositional areas (i.e., resting pools and spawning areas), seasonal temperature regulation, seasonal habitat (e.g., side channels), and cover. In the Middle Applegate Watershed, extensive manipulation of stream and river channels has drastically altered the riparian areas in both lowland and upslope areas.

Riparian zone functions and processes are discussed in more detail in the Riparian and Fish Report (Haight 1995).

Channel Geomorphology

In low gradient, unconfined stream valleys, stream channels have been altered by past mining activity and conversion of rich floodplain areas into agricultural land (LaLande 1995). The Applegate River, the lower reaches of Thompson Creek, Humbug Creek, and Forest Creek do not have the ribboned channels and wide flood plains that were there historically (USDA and USDI 1994c). Because they have become disassociated from their adjacent flood plains, water tables in adjacent riparian areas have dropped. Once abundant off-channel and backwater areas for fish rearing and habitat needs are now unavailable for fish use. Channelization has also increased the speed of flow, changing depositional zones into transport zones, and effectively removing needed gravel from the system (USDA and USDI 1995a).

Channel constriction on the Applegate River is further pronounced in three reaches by rock levees. Two levees, each extending a distance of 250 yards, are located in the lower portion of the Middle Applegate. One is at river mile 19.25, near Slagle Creek, and the other at river mile 23.00, near Cook Cove. Another 200 yard long levee is located at river mile 30.00, near Watney Gulch (downstream from Forest Creek). The levees were constructed following major flood events. The 1964 and 1974 floods were especially devastating to agricultural land along the Applegate River. Evidence of extensive scouring can still be seen in some places.

Besides agricultural land development and flood control, road construction has also restricted the natural meander of streams and the dynamic character of floodplains. The Middle Applegate Watershed has approximately 5.51 square miles of riparian habitat on fish-bearing streams. Within this riparian habitat, there are approximately 68.37 miles of roads (Medford GIS). This averages to 12.4 miles of roads for every square mile of riparian habitat.

Most of the low-gradient areas discussed above are privately owned.

The Applegate Dam has had both negative and positive effects on the Applegate River. Fewer and smaller peak flows have altered the geomorphic character of the channel. The annual scour and deposition pattern has changed, affecting pool/riffle ratios and gravel bars. However, water is released during the summer, which offsets the amount of water diverted from the Applegate River for agriculture and residential use. Extreme low flows are less common.

Riparian Vegetation

Because the Applegate Dam has reduced peak flows, riparian vegetation has encroached upon the channel. Introduced Himalayan blackberries are a particular problem. Previously, high flows cleared out blackberries and other channel-choking vegetation. This vegetation has increased streamflow resistance and reduced channel capacity thus allowing water to flood out of the river's banks at lower flows than it would have historically (USDA and USDI 1994c).

Along the Applegate River and along the lower reaches of Slagle, Thompson, Humbug, and Forest creeks, agricultural and residential development has reduced riparian vegetation to a narrow band of only a few hardy species. In a few short reaches, riparian vegetation is entirely absent. The Corps of Engineers encourages vegetation removal from the rock levees built along the Applegate River. This action prevents riparian vegetation from becoming established on the levees.

In the upper stream reaches of the Middle Applegate, fire suppression and riparian logging have created riparian zones dominated by dense stands of younger age conifers lacking in large overstory structure. In some cases, dense stands of hardwoods and shrubs have established in clearcut riparian areas. These areas lack age and species diversity, and cannot contribute a sufficient volume of coarse woody debris. As previously mentioned, road construction has also impacted riparian vegetation.

Riparian vegetation is a source of coarse woody debris for stream channels, floodplains, and riparian zones. Based on observations in the Middle Applegate, the Applegate River and significant portions of its tributaries lack adequate quantities of coarse woody debris to dissipate flood energy or to provide aquatic and terrestrial habitat. An occasional large log or fallen tree can be seen along the Applegate River, but woody material along the tributaries is mostly limited to small diameter trees and limbs, which are easily swept downstream by winter flows. A stream/riparian survey is needed in the Middle Applegate to quantify the coarse woody debris component.

Riparian vegetation condition is discussed in more detail in the Riparian and Fish Report (Haight 1995).

Fish

The Applegate River basin is host to runs of anadromous fish, as well as resident trout, native non-game fish, and an assortment of introduced game and non-game fish. The basin is considered to be especially important because of its runs of anadromous fish which include fall chinook salmon, coho, summer and winter steelhead, and Pacific lamprey. Both cutthroat and rainbow trout are present. The list of species also includes three native non-game fish species and ten introduced species. Table 14 lists fish species found in the basin.

Table 14. Fish Species Found in the Middle Applegate Watershed

Fish Species		Habitat		
Common Name[1]	Scientific Name	Streams	Lakes	Ponds
Pacific Brook Lamprey	*Lampetra pacifica*	X		
Pacific Lamprey	*Lampetra tridentata*	X		
Coho Salmon (G)	*Oncorhynchus kisutch*	X		
Fall Chinook Salmon (G)	*Oncorhynchus tshawytscha*	X		
Cutthroat Trout (G)	*Oncorhynchus clarki*	X	X	
Rainbow Trout and steelhead (G)	*Oncorhynchus mykiss*	X	X	X
Umpqua Squawfish (I)	*Ptychocheilus umpquae*	X		
Redside Shiner (I)	*Richardsonius balteatus*	X		
Klamath Smallscale Sucker	*Catostomus rimiculus*	X		
Mosquitofish (I)	*Gambusia affinis*	X		X
Green Sunfish (G,I)	*Lepomis cyanellus*		X	X
Pumpkinseed (G,I)	*Lepomis gibbosus*		X	X
Bluegill (G,I)	*Lepomis macrochirus*		X	X
Smallmouth Bass (G,I)	*Micropterus dolomieui*	X	X	X
Largemouth Bass (G,I)	*Micropterus salmoides*		X	X

Fish Species		Habitat		
Common Name[1]	Scientific Name	Streams	Lakes	Ponds
White Crappie (G,I)	*Pomoxis annularis*		X	X
Black Crappie (G,I)	*Pomoxis nigromaculatus*		X	X
Reticulate Sculpin	*Cottus perplexus*	X	X	X

1/ G - Game fish by State Legal Definitions
I - Introduced

This section provides a brief discussion of the fish species found here. Included are life history, habitat requirements, and the distribution and magnitude of the populations. More detailed information on the anadromous fish and resident trout is provided in the Riparian and Fish Report (Haight 1995).

Salmon, steelhead, and resident trout utilize portions of perennial streams and some of the intermittent streams in the Middle Applegate Watershed. Fish bearing streams in the watershed total approximately 46 miles. Warm-water game fish species are found mostly in private ponds, but also reside in some of the deep pool habitats in the Applegate River.

Within the Middle Applegate Watershed, fall chinook salmon spawn from October to mid-December along the entire length of the Applegate River and in the first mile of Thompson Creek (Map 14). Fall chinook fry migrate out of the watershed by May, so summer rearing is not a concern with this species. The regulated flow in the Applegate River from the Applegate Dam has benefitted the fall chinook. Flows offset water withdrawals and are sufficient to attract upstream migrating fish. For the most part, peak flows are controlled enough to prevent scouring of redds. An analysis of ODFW spawning ground counts shows that the run of fall chinook salmon has increased by about 86 percent in the river since the dam became operational in 1980 (ODFW 1995).

Future runs of chinook salmon are likely to be enhanced if the following habitat criteria are maintained:

* legally allocated minimum flows in the Applegate River,
* silt-free spawning beds of suitable-sized material,
* a 40-60 percent pool/riffle relationship in the Applegate, and
* pools greater than five feet deep for use by resting adult salmon.

The coho salmon population in the Applegate system has not fared as well as the fall chinook. Only a remnant spawning run (less than 100 fish) remains today in the Applegate and in lower Thompson Creek (Map 15). Juveniles have very specific habitat requirements, and, unlike fall chinook, must remain in the parent stream for a year before smolting and migrating to the ocean. Such long residence time makes them much more susceptible to long-term habitat degradation. Because coho are also fall spawners, the operation of Applegate Dam is presumably benefiting this species, but coho returns have not been monitored since the dam was constructed.

In the Middle Applegate Watershed, summer and winter steelhead spawn in the Applegate River and several tributaries, including Slagle, Humbug, Thompson, and Forest creeks (Map 16). Steelhead are more tolerant of high water temperatures than coho, and can rear in a greater variety of habitats. Of the two steelhead races, the summer run has experienced more habitat alteration. This is especially true on Forest Creek where gold dredge piles now block the upstream migration of steelhead at river mile 4.0. Steelhead also spawn in small, often intermittent tributaries. Winter steelhead redds were counted during a stream survey conducted by ODFW in March 1965. Over 300 redds were recorded for the Applegate River from the mouth of Williams Creek to the mouth of the Little Applegate River. Another 78 redds were counted in lower Thompson Creek. The ODFW estimates that about 1,400 summer steelhead spawn in about 15 miles of stream. The actual number of steelhead that spawn in the Middle Applegate is unknown.

The BLM conducts annual spawning ground counts of summer steelhead in lower Ninemile Creek. Counts since 1984 have averaged just over 19 redds per mile. However, that figure includes three years when drought conditions resulted in flows too low to attract spawning fish (Arnold, pers. com. 1995).

Resident trout are found in most perennial streams in the watershed (Map 17). Cutthroat trout seem to be limited to the Applegate River and lower reaches of larger tributaries. Rainbow are found in upper reaches and above natural barriers. The relative size of trout populations and their distribution in the watershed are unknown. Trout are subjected to most of the habitat problems confronting anadromous fish, but may also combat additional problems such as irrigation dams and improperly designed culverts. Dams and culverts often block upstream fish migration.

Other native fish species in the watershed include the Pacific lamprey, Pacific brook lamprey, Klamath smallscale sucker and reticulate sculpin. The Pacific lamprey is anadromous, while the other three species are resident. No inventories of these fish species have been conducted, but it appears that the two species of lampreys are declining in the Rogue River system.

Several introduced fish species reside in the Middle Applegate Watershed. The Redside shiner and Umpqua squawfish occupy glide and pool habitats in the Applegate River. The Mosquitofish, and various warm-water game fish are found primarily in private ponds. Smallmouth bass have become well established in Applegate Lake, and may populate pool and glide habitats in the Applegate River at some point in the future. Introduced fish impact native species in varying degrees by competition, predation, or dilution of genetic integration from interbreeding. No in-depth studies have been undertaken in the Middle Applegate to determine the extent of impacts.

Special Status Species

The National Marine Fisheries Service (NMFS) has been petitioned to include Oregon south coast coho stocks on the federal list of threatened and endangered species. In February 1995, NMFS decided that steelhead stocks south of Cape Blanco, including those in the Rogue River system, meet criteria for listing under the 1973 Endangered Species Act. At the time of preparing this document, NMFS has not yet made a decision about coho salmon. The Oregon Fish and Wildlife Commission, in responding to a petition to place the coho on the state list of threatened and endangered species, made a ruling at their regular meeting in March 1995, that the fish did not meet requirements for listing under the Oregon Endangered Species Act. Neither the coho or steelhead is included on the Medford District BLM's list of special status species.

Immature forms of two different taxa that appear to be Category 2 species under the Endangered Species Act were found during aquatic macroinvertebrate sampling in the Little Applegate River drainage (Wisseman 1995). The two insects are the Clatsop pholcascan caddisfly, *Philocasca oron,* and the Siskiyou caddisfly, *Tinodes siskiyou.* The close proximity of this watershed to the Middle Applegate Watershed presents a possibility that the two caddisflies inhabit the Middle Applegate as well. Field investigation will need to be done in headwater streams to determine their presence.

Fish Barriers

Before the Applegate Dam became operational, gravel irrigation diversion dams were constructed across the width of the Applegate River and posed a passage problem to early arriving fall chinook salmon. These dams were usually breached by storms by late October. Augmented flows from the Applegate Dam now make upstream movement for chinook free of delays. Upstream migration of fall-spawning coho also appears to be free of obstacles, and this is probably the case for most winter steelhead migration. Summer steelhead, on the other hand, are met by passage challenges. On Forest Creek a concrete bridge pier at river mile 2.0 and an old concrete irrigation diversion dam at river mile 2.25 form partial barriers, and fish are totally blocked by mine tailings at river mile 4.0. Resident trout are also blocked by both natural and man-made barriers. On lower Chapman Creek, for instance, there is a twenty-foot rock falls about one quarter of mile above its mouth. Another suspected barrier to trout on this stream is the culvert on Road # 38-3-32.1.

Often when juvenile coho, steelhead and trout are attempting to leave drying tributaries they are intercepted by small dams, and diverted into irrigation ditches. Most of the ditches are fitted with fish screens that are maintained by the Oregon Department of Fish and Wildlife. The screens block fish from traveling down the ditches and by-pass the youngsters back to the stream. Unfortunately, not all ditches are fitted with screens. This is more often the case on streams that only support resident trout. Two unscreened ditches are on Thompson Creek (Budziak, pers. com. 1995). Another is on Chapman Creek.

Sport and Commercial Fisheries

Fall chinook salmon and coho are ocean-harvested during limited sport and commercial fisheries, and are taken by sport anglers in the Rogue River. Salmon produced in the Middle Applegate Watershed are subject to harvest in both the ocean and river fisheries, but the number of fish harvested is unknown.

Winter and summer steelhead are taken by sport anglers in the Rogue and Applegate River. The Applegate River itself is closed to steelhead angling from November 1 to January 1. Therefore, many summer steelhead are already on their spawning grounds and avoid harvest in this stream. There is a popular sports fishery in the Applegate River for winter-run steelhead.

There is no way of knowing how many Applegate produced steelhead are taken in the sports fishery in the Rogue River, but ODFW records do provide angler catch data for the Applegate River. The annual catch for the period from 1982 to 1993 ranges from a low of 149 fish caught to a high of 2,146 (Evenson, pers. com. 1995). The average catch for the twelve year period is 997 fish.

Macroinvertebrates

The importance of aquatic insects in the stream ecosystem cannot be over-emphasized. They provide a majority of the food supply for resident and anadromous fish and are an essential link in the decomposition and nutrient retention cycles. Snails, fresh water mussels, crayfish and worms also contribute to the food web in the stream environment. They are filter feeders, grazers, scavengers and predators, and all play roles in a balanced ecosystem. While some aquatic insects (for example, mosquitos) can exist in extremely degraded environments, macroinvertebrates which have evolved in cool water, low sediment, seasonally flooded rivers and streams are often very intolerant of water diversion, sedimentation, and channelization. The disappearance of less-tolerant species from a stream or river is often used as an indicator of declining water quality. Very different insect communities exist in different areas within streams and rivers, as well as in ponds, lakes, and springs. All major habitat types within the aquatic ecosystem are needed to conserve diversity.

INTERPRETATION

HUMAN DIMENSION

Mining

Because of its past mining history, the Middle Applegate Watershed continues to be a focal point for groups and individuals interested in gold and silver exploration. Future mining activity will most likely be small placer operations using suction dredges.

A site specific inventory is needed to determine locations of closed claims needing rehabilitation. Potential restoration projects may include addressing safety hazards, cleaning up trash dumps, removing abandoned vehicles, mitigating and grating abandoned mine shafts, and revegetating claim areas.

Grazing

Although livestock are still a common sight on private lands, public lands grazing is on a definite decline in the Middle Applegate Watershed. Some of the reasons for the decline are listed below.

1. A poor economic market.
2. Insufficient private acreage to support an economically viable operation.
3. Reduction in grazeable public land as the rural population and subsequent conflicts increase.
4. An overall increase in regulations pertaining to livestock grazing.

This trend is not expected to reverse in the near future as population and grazing restrictions (either real or perceived) continue to increase. Along with this decline over the past several decades has been a decrease in the size of livestock operations. Instead of a few large economically self-supporting operations, there are now several smaller operations which are not as economically viable.

It is not clear what the social and ecological implications of these trends will mean for the Middle Applegate Watershed. As public land grazing decreases, then arguably the condition of these lands will improve. However, unless livestock are completely removed from the entire watershed, which is highly unlikely, greater pressure will be placed on private lands. Considering that private lands contain most of the riparian habitat adjacent to fish-bearing streams, from a watershed perspective, the ecological implications of reduced public land grazing is not automatically positive. Many Applegate Valley residents also want "ecosystem management that strengthens the traditional economic sectors" (USDI and USDA 1994c). Therefore, the social implications may also be negative.

To truly evaluate the implications and future management direction of livestock grazing within the Middle Applegate Watershed, both the ecological and social implications must be considered.

Where resource problems exist on public lands, the current policy is to rectify the problem through management adjustments made in consultation with the permittee. If the situation remains unresolved then Grazing Decisions are issued. It is doubtful that *Rangeland Reform* (USDA and USDI 1994d), which is scheduled for release in August 1995, will significantly alter this policy.

Logging

The Middle Applegate Watershed lies within the Applegate Adaptive Management Area (AMA), which was created by the 1994 Northwest Forest Plan. The AMA is designed to develop and test new management approaches to integrate and achieve ecological, economic, and other social and community objectives (USDA and USDI 1994a). The emphasis of the Applegate AMA includes the development and testing of forest management practices, including partial cutting, prescribed burning, and low impact approaches to forest harvest (e.g., aerial systems) that provide for a broad range of forest values, including late-successional forest and high quality riparian habitat.

The Ashland Resource Area is planning landscape treatments in the Middle Applegate to incorporate these AMA standards and guidelines. Future road building will be minimized. Tractor and cable systems will be used adjacent to existing roads and aerial systems such as helicopters will be used where there is no road access.

Transportation

The recent decline in timber harvest on BLM-administered lands has seriously reduced the maintenance funds required to maintain the present transportation system. This has limited the BLM's ability to finance maintenance of extensive road systems. Due to resource conflicts and a reduced demand, some roads will be removed from the system, others closed until future access is needed, and many others kept at the lowest possible maintenance levels. Gates and other road barriers may be used to regulate road access when erosion and/or wildlife concerns are present.

Road surfaces may be improved to allow for heavier traffic, prevent erosion, and/or repair of damaged sections. Road surface improvements may include protection materials such as aggregate base course (ABC), aggregate surface course (ASC), and bituminous surface treatment (BST).

BLM-controlled roads identified for improvements will also be evaluated for drainage problems. Future drainage structures will be designed to withstand a 100-year flood event.

Culverts on fish-bearing streams will be installed with less than two percent slope to ensure fish passage.

Roads are routinely inspected for hazard trees. Hazard trees may be removed if they are a safety concern. In general, hazard trees have the potential to fall towards the road. They are usually dead, but may be alive with undercut roots or significant physical trunk damage.

Rights-of-Way

The BLM will continue to grant rights-of-way for others to use BLM roads and obtain easements for roads that cross private properties.

BLM will continue to accept applications for non-road rights-of-way. Each inquiry or application will be reviewed in a timely manner and on its own merits. Once an application is accepted, BLM will conduct a thorough, reasoned analysis to determine whether a right-of-way is to be granted.

BLM will follow a similar process with respect to leases, permits, and exchanges (i.e. inquiry, application acceptance, review, and determination).

Recreation

Existing recreational use of public lands in the Middle Applegate Watershed does not warrant development of new recreational facilities. However, the BLM will evaluate recreational use in the future and develop recreational opportunities as the need arises. BLM will continue to encourage dispersed and established site recreation and work with private landowners to maintain access to recreational facilities. BLM will also continue to work closely with local off-highway vehicle (OHV) groups to reduce conflicts, maintain trails, and prevent erosion problems.

Residential Growth and Rural Interface

Residential development pressures in the Middle Applegate are not expected to diminish in the near future. Large blocks of agricultural land will undoubtedly continue to be subdivided for home sites. As this property is developed, and the price of valley land rises, there will likely be continued pressure to extend residential areas further and further into lands previously managed for forest or agriculture production. Residential development in rural interface areas will increase impacts on roads, water, and wildlife, as well as increase the complexity of public land management.

Extensions into previously undeveloped land will require road construction or improvements to the existing road system. This will most likely increase traffic on BLM-controlled roads. Roads will deteriorate faster, requiring additional maintenance expenditures. Road safety issues will increase, especially if commercial hauling occurs on BLM roads also used by local residents. More turnouts, dust suppression, or speed controls may be needed in the more developed areas. As private forest lands are parceled for home sites, management of adjacent BLM-administered lands may become increasingly restricted. Acquiring easements will become increasingly costly. Rights-of-way for fuel breaks and access to private land across public lands will also increase.

Continued development will increase demand for wells, springs, and water diversions from streams at the expense of riparian zones, aquatic resources, and water sources for terrestrial wildlife. There could be increasing demands to compensate for any overallocation by exploiting public lands. Increased human development will result in increased habitat fragmentation. This could lead to a decrease in the abundance and diversity of the native flora and fauna.

Development in forested areas will hamper fire suppression. Firefighting costs may rise as more personnel are needed to protect residential areas. Because suppression resources are first allocated to protect life and property, resources available for direct suppression in non-residential areas are reduced. This may result in more forested area burned and therefore, the loss of forest resources. Prescribed burning for land management purposes or fire risk reduction may also be hampered by public concern about safety and air quality issues.

Cadastral needs may increase as will problems to address inadvertent or intentional trespass. As costs to dispose of waste products in landfills increase, there may be increased trash dumping on public lands. The BLM plans to continue actively monitoring, investigating, and pursuing unauthorized uses on public lands.

Support systems such as fire, police, and ambulance services will be increasingly difficult to maintain at existing levels if present trends for reduced taxes continue.

As rural interface areas become more extensive and intensively developed, forest health concerns will gain emphasis. The public will continue to want to be actively involved in public land forest health decisions that directly affect their property. This will require more intensive planning and increased public involvement. Special interest groups will continue to monitor and comment on public land management activities in the Middle Applegate. Project planning will become more complex and land management options may become more constrained.

TERRESTRIAL COMPONENTS

Soil

The Middle Applegate Watershed is characterized by mountainous terrain divided by narrow valleys. Soils on the upland slopes are typically developed from metavolcanic colluvium, but soils developed from granitic colluvium are also present. The very steep, metamorphic Caris and Offenbacher soils and the steep, granitic Tallowbox soils are of greatest concern in terms of erosion hazard (Map 18). Because Caris and Offenbacher soils occur on very steep slopes with local areas of ravel accumulation, they are particularly subject to erosive forces. New road construction and intensive logging practices are not desirable on these soils with slopes greater than 65 percent. Tallowbox and Rogue soils are subject to particle detachment because they are on steep slopes with very thin layers of protective duff and low clay content. New road construction should be discouraged on these soils and only light partial cutting with minimal surface disturbance should be considered on a site-specific basis.

Naturally occurring upland slope processes in the Middle Applegate consist mainly of colluvial movement, water erosion, and deep weathering. Colluvial movement is the slow, mass movement downslope of unconsolidated material. Most soils on steep and very steep slopes are developed in colluvium. Local sites of ravel or gravel on the surface of the Caris and Offenbacher soils are an example of current colluvial phenomenon. Water erosion occurred prior to Euro-American settlement in localized areas where low intensity fires eliminated surface protective cover. Deep weathering is an ongoing process that occurs on moderately steep base and side slopes and some ridge shoulder slopes.

Site productivity levels are a result of several factors above and below the soil surface. Beneficial organisms rely on accumulating organic material in the form of duff and woody debris. Inherent soil characteristics such as rooting depth, surface soil thickness, and natural bulk densities are also important factors in determining site productivity. No data is available on relative soil productivity ratings for the Middle Applegate Watershed.

Coarse woody debris appears to be small in quantity and dimension throughout the forested lands in the Middle Applegate. In lower Thompson Creek most sites have five tons per acre or less. Tree diameters do not usually reach greater than 20 inches. This is probably due to past fire frequency and poor growing conditions. Natural levels of woody debris accumulation in healthy stands should be used to establish down wood and long-term recruitment recommendations.

Under unmanaged forested conditions (hardwoods, conifer poles and larger) duff thickness in lower Thompson Creek is usually 0.5 inch or less (Haupt, pers. com. 1995). Although the duff/litter layer is relatively thin in the Middle Applegate, areal coverage over the mineral soil surface is fairly extensive (McCrimmon and Atzet 1992). Observations in managed stands suggest that duff/litter thickness is roughly equivalent to the unmanaged forest.

Natural bulk density of soils can be increased by mechanical means such as tractor logging. Compaction (increased bulk density) decreases site productivity. The extent of compacted areas within the Middle Applegate is moderate to low. Small, highly compacted areas in the headwaters of Thompson Creek, Rock Gulch, and Ferris Gulch should be treated by deep tilling. Future treatments in the Middle Applegate should minimize the extent of compaction.

Productivity has been reduced or eliminated on areas occupied by roads and off-highway vehicle (OHV) trails. Roads funnel concentrated surface water and intercepted shallow ground water to downslope surfaces. Rutting commonly occurs on open, unsurfaced roads. OHV trails are also subject to rutting and mechanical detachment. Areas of accelerated erosion need to be identified on a map, and plans developed to stop and/or reduce erosion on these identified sites.

Terrestrial Vegetation

In general, vegetation density levels are much higher than in the past, especially in conifer forests. Conifer stands in the Middle Applegate also seem to be more homogeneous than in the past. Many trees that are over 200 years old with old-growth characteristics have been killed by the competing, second growth trees. Due to fire suppression and past logging, the ponderosa pine, knobcone pine, and incense cedar stands are converting to Douglas-fir, the climax species for the majority of the forested area. Douglas-fir is even encroaching upon the edges of the oak woodlands. Whiteleaf manzanita and *Ceanothus* species are also migrating into the oak woodlands and replacing the oaks, pines, and native grass species. White fir is migrating to lower elevations and encroaching upon the Douglas-fir tree series.

The Klamath Geologic Province, of which the Middle Applegate Watershed is a part, is characterized by historically high fire frequencies (10 to 30 year return interval). Intensive fire suppression efforts have resulted in structural and compositional changes in habitats capable of supporting rare plants. Forested lands have become overly dense and are losing their component of pine and cedar. Oak savannas, oak woodlands, and meadows have undergone a herbaceous species conversion and are being invaded by conifers. Shrub communities are reaching maximum stocking levels and are being invaded by conifers.

The primary natural processes influencing stand development patterns are diseases and insects. *Phellinus pini* has infected dense Douglas-fir stands over 100 years of age and is slowly creating snags and openings in the tree canopy layer. Bark beetles are also killing trees and starting to open the tree canopy layer. These natural processes are moving the forest to the understory reinitiation phase (Oliver and Larson 1990). Even-aged stands without residual old-growth trees may still require an additional 150 years to develop an old-growth condition as defined by Oliver and Larson (1990). However, old-growth stand characteristics may be developed in less time.

The majority of the mature/old-growth condition class stands have entered the understory reinitiation stage. Stand structure varies from site to site and depends on stand establishment and history, soil conditions, topography, aspect, and available moisture. As a general rule, water availability limits the number and size of the mature trees. Established second growth trees and natural regeneration compete with mature trees for the available water. Density management of overstory and understory trees and vegetation is critical to the survival of mature trees.

The majority of commercial timber stands are in the mid condition class. Older, mature trees are found scattered throughout these stands. Most of the mid condition class stands have never been managed and generally they are overstocked with suppressed trees. Bark beetles are a major threat for stand mortality, even if the stands are thinned now.

Stands of pole timber are presently overstocked and if not treated are at risk of increased mortality. Bark beetles are a threat as well as snow, ice, and wind damage to the tall, small diameter trees. As the crown ratios of the trees decline (because of overstocking) tree vigor will also decrease and the probability of bark beetle infestations will increase.

Early successional stands will likely develop into even-aged, single canopy layer stands without silvicultural treatment. Existing early successional commercial timber stands (early and seedlings/saplings condition class) should be guided towards the development of structural diversity by favoring different age, diameter and height classes. Various tree species as well as tree spacings should be prescribed. Precommercial thinning should also promote the development of multiple canopy layers.

The extent of the ponderosa pine forest type is greatly reduced from historic levels and it is probably at the low end of its historic range (Haupt, Moore, and Tong 1995). The ponderosa pine series will not be able to expand, or perhaps survive, without large scale natural disturbances or the intervention of silvicultural prescriptions for favoring the species. Large openings in the forest canopy layer must be created as well as a suitable seedbed for Ponderosa pine populations to increase.

Like the pine series, the oak series will not be able to expand or remain stable in size. Without the occurrence of fire, Douglas-fir and shrub species will continue to encroach upon the oak series. Some oak stands are overstocked and not able to produce a seed crop for regeneration. The ecological functions of the native grass/oak woodlands plant associations could be lost.

Lack of fire in the shrublands has created maximum vegetation stocking levels and an extremely high fire hazard. Tree species have encroached into the shrublands as well. Without treatment vegetation will continue to die and create even more fire fuels. The quality of deer browse will also decline as shrub and hardwood growth matures and stagnates.

Forest openings (i.e., grass, forbs, herbaceous condition class) in the watershed are at risk. This is due to the invasion of trees, shrubs, and exotic plant species such as yellow star thistle, hedgehog, dogtail, medusahead rye, cheatgrass, and ripgut brome. Fire is the ecological process which historically maintained this community. However, it is unknown if a disturbance (such as fire) will rejuvenate the native community or favor further encroachment by these exotic species. Research is needed.

Trees in the Middle Applegate are growing at the slowest rates since the 1800s. Stand vigor is decreasing because timber stands are significantly overstocked. Relative density index ratings in lower Thompson Creek indicate that stands are at the point of imminent mortality and suppression. Decreases in tree vigor and growth have contributed to an overall decline in forest health.

Forest health is quantified by assessing the physical environment itself, the forest's resistance to catastrophic change, tree mortality, changes in tree growth and vigor, changes in species composition, erosion, water drainage, streamflow, and nutrient cycling. According to the *Applegate Adaptive Management Area Ecosystem Health Assessment* (USDA and USDI 1994c), the physical, biotic, and trophic networks (natural functions and processes) are intact and working in the Adaptive Management Area, except where soil erosion or raveling occurs, where certain stream reaches are aggraded, or where high elevation clearcuts are still non-reforested. These eroded, aggraded, and non-reforested areas represent a small portion of the Middle Applegate.

A healthy forest ecosystem has the physical environment, biotic resources, and trophic networks to sustain processes and viable populations of indigenous species. When these criteria are met, the ecosystem is able to maintain its productivity and resiliency over time when exposed to drought, wildfire, insect attack, or human-induced changes.

However, the Middle Applegate Watershed may not be resilient to catastrophic change. As mentioned earlier, vegetation densities are very high and ladder fuels are abundant. Vegetation mortality is already occurring because of plant competition and expanding bark beetle populations, so the stage is being set for catastrophic, stand replacement fires. As previously discussed, stand species composition and structure shifts could also be considered unhealthy. The replacement of ponderosa pine by Douglas-fir increases the percentage of drought-susceptible trees in a stand. Therefore, the risk of beetle infestation and/or a wildfire also increases.

Plant Communities of Special Importance

Valley bottom late seral communities and low-middle elevation grasslands/savannahs are threatened by human-caused disturbances. Valley bottom plant communities are being eradicated in favor of agricultural and ranch land, homesites, and roads. Much of these valley bottom plant communities may not be recoverable. These lands are typically privately owned and developed. Native grasslands are being invaded by exotic species.

Special Status Plants

The primary risk to special status plants in the Middle Applegate is human-caused actions directly impacting rare plant populations and their habitat. Without precise historical or specific biological data, the circumstances causing specific plant rarity remain unclear. The relationship between these plant populations and their required habitats needs to be examined. Table 15 lists special status species and the habitats in which they are found.

Table 15. Special Status Plant Habitat

Habitat	Species
forest, riparian	*Cypripedium fasciculatum* *Cypripedium montanum*
oak woodland, grassland	*Fritillaria gentneri* *Mimulus douglasii*
shrubland	*Fritillaria gentneri*
rock	*Sedum laxum ssp. heckneri* *Sedum oblanceolatum*

These special status species should be considered at risk of extirpation from the watershed because they may occur only in rare habitats, their habitats may be threatened, they may be very localized, or their populations may consist of few individuals.

Rare plant habitat loss and degradation on public land should improve with the BLM's adoption of the Northwest Forest Plan (USDA and USDI 1994a) and the Medford District Resource Management Plan (USDI 1994b). These plans include conservation and protection of late successional forests and riparian areas. These habitats are capable of supporting numerous rare vascular and nonvascular plants. However, on private land, the downward trend will likely continue due to the current and increasing demand on land and water resources.

Currently planned and future projects should have positive effects on rare plant habitat. Forest stand density management, reintroduction of fire through controlled burns in all condition classes, collection and growing native plant seed for restoration and reseeding, are all examples of planned projects that will improve potential rare plant habitat.

Special Emphasis Species (Noxious Weeds)

Very little is known about the distribution of noxious weeds within the Middle Applegate Watershed. Noxious weed populations appear to be increasing. Based on current knowledge, the economical and ecological elimination of some species such as star thistle is unlikely. If present trends continue, the ability to control other species will also diminish.

Noxious weed populations must be located quickly to increase the effectiveness of control efforts.

The Oregon Department of Agriculture is focusing research on identifying biological control agents. Biological control agents are successful at controlling some species such as tansy ragwort, which is known to occur in Thompson Creek. This control method appears promising for several other species, however, it is still too early to draw any definitive conclusions.

Fire and Air

In the past, fire was an integral part of the ecosystem, affecting air quality, wildlife habitat, forest stand dynamics, soil properties, and watershed hydrology.

Major fire disturbances have always been common in the Middle Applegate. Prior to fire suppression there were short fire-return intervals (10 to 30 years) with low severity fires (Agee 1993). Fire suppression since the turn of the century and logging since about 1950 have changed the extent and role of fire in the Middle Applegate (USDA 1990). Fire suppression has removed the majority of low-moderate severity fire events, but it has also allowed fuel accumulations in forest stands. The population trend, for the Middle Applegate, has been on a steady increase since the 1800s. The probability of a major, severe (stand-replacement) fire in the Middle Applegate increases yearly.

The large accumulations of forest fuels need to be reduced to a manageable level to minimize the potential of a stand-replacing fire in the Middle Applegate. The initial fuel treatment for the majority of the landscape should emphasize utilization, chipping, and hand piling. Future maintenance of fuel levels will be needed to maintain a low fire hazard. The preferred maintenance method is a low intensity underburn across the landscape.

Wildlife Species and Habitat

Vegetative conditions are the primary influence on terrestrial populations and their distribution within the watershed. As described in previous sections of this analysis, a variety of processes have changed vegetative conditions over time, including natural succession, natural disturbances and human-caused disturbances. Existing conditions differ considerably from reference conditions primarily due to human-caused disturbances.

The following generalizations can be made in comparing current conditions to reference conditions.

> Populations of species preferring the structure and conditions provided by the mature/old-growth condition class have likely declined. This condition class has historically provided the bulk of the timber, and it has been removed faster than it can be replaced.

Habitat quality in the mid condition class has declined. Historically, this condition class had a less dense canopy due to fires. The more open canopy allowed the establishment of understory vegetation. Due to fire suppression many stands in this condition class now have a high degree of canopy closure and sparse understory vegetation. Data in Brown (1985) suggest that stands with multiple vegetative layers are used by approximately twice as many vertebrate terrestrial wildlife species as those with dense canopies and sparse understory vegetation.

Most of the early/seedling-sapling and pole habitat is the result of timber harvest and consequently, snags are lacking. Except for the lack of snags, these condition classes appear to be in good condition. Populations of those species requiring snags in these condition classes have likely declined, while populations of species not requiring snags may have increased.

The absence of fire has also allowed much of the oak-woodlands to become over-dense. This has slowed growth and retarded mast production. Large oaks which provide natural cavities and acorns are important to a variety of wildlife species. Populations of those species which utilize these two features of the oak-woodlands have probably declined.

The quality of shrubland habitat has declined due to fire suppression. Generally, fire is the primary agent for creating early seral stages in this plant community. In the absence of fire much of this habitat type has matured and early seral stages are deficient.

Habitat quality of the grass/forb/herbaceous condition class has declined due to the invasion of noxious grasses and forbs. This has had an adverse impact on the herbivores in the watershed.

Overall, it seems apparent that some species have been adversely affected by the general decline in habitat quality within the watershed. Loss or modification of habitat is probably most pronounced in the mature/old-growth condition class, and wildlife species associated with this habitat have likely been the most affected.

Under current management direction habitat condition will likely improve in some condition classes on BLM-managed lands. Initially, the mid condition class and some of the mature condition class are a high priority for treatment. Recommended treatments in these condition classes include thinning over-dense stands which will improve overall structure through promoting individual tree growth and understory vegetation development. These treatments should accelerate recruitment into the mature/old-growth condition class. Maintenance of the mature/old-growth condition class is a long-term objective. Thinning oak-woodlands should promote both growth and acorn production. Converting a portion of the decadent shrublands to early seral stages of this condition class will likely improve diversity in this habitat.

Over time a decrease in the frequency of large patches of early-seedling/sapling and pole condition classes is likely. Although data on patch size utilization by species preferring these habitat types are lacking, it is assumed that large patches enhance populations of some species due to territoriality. The primary modes for developing large patches of this condition class are wildfires and clearcut timber harvest. It is assumed that fire hazard reduction and fire suppression will reduce the occurrence of wildfires and harvest methods other than clearcutting remain high priority management objectives on BLM- managed lands. Therefore, development of large patches of early-seedling/sapling and pole habitat will depend on private land treatments. This may be adequate to accommodate those species utilizing large patches, but depending on economic conditions, spikes in habitat availability are more likely to occur than the preferred even, temporal distribution.

AQUATIC COMPONENTS

Water Quantity

Streamflow in the Middle Applegate Watershed fluctuates with seasonal variations in precipitation. Approximately 80 to 90 percent of the annual water yield occurs from November through April in the Applegate River tributaries. Runoff usually peaks in February and March, however, historic extreme flood events in the Applegate Subbasin have generally occurred in December and January as a result of rain-on-snow storm events. The lowest streamflows generally occur in August and September. The Applegate Reservoir, which was completed in 1980, has moderated both high and low flows in the mainstem.

Both natural and human-caused disturbances have likely affected the timing and magnitude of peak flows in the Middle Applegate Watershed. Prior to organized fire suppression in the early 1900s, there was a frequent fire return interval and vegetation was eliminated over large areas burned by wildfires. On a landscape basis, fires were estimated to result in stand replacement for about 20 percent of an area (USDA 1994). This resulted in reduced interception and transpiration and allowed more water to reach the streams.

Vegetation removal, roads, and soil compaction are the primary human-caused disturbances that have the potential to affect the timing and magnitude of peak flows in the Middle Applegate Watershed. Human-caused disturbances probably began with Native Americans clearing small areas of land by burning the vegetation. Farmers and miners continued this practice from the 1850s to the 1920s. They cleared valley bottoms and converted them to pastureland. The road network greatly expanded with the advent of logging. Logging activities began in the late 1800s and continue into the present. The resulting combination of vegetation removal, road building, and yarding most likely contributed to increases in the frequency and magnitude of peak flows during the past five decades.

Under the Medford District Resource Management Plan (USDI 1994b), vegetation removal on BLM-administered lands will be greatly reduced and clearcutting will not be prescribed in the Middle Applegate. Adherence to the Aquatic Conservation Strategy in the Northwest Forest Plan (USDA and USDI 1994a) will result in less road building, more road decommissioning and upgrading, and less soil compaction from yarding on federal lands.

These factors will reduce the likelihood of increasing the frequency and magnitude of peak flows.

Summer streamflows are naturally low due to the low summer rainfall. This condition existed in historic and most likely prehistoric periods. Extremely low streamflows have been recorded in the past and present as a result of extended periods of below normal precipitation. As stand density in the Middle Applegate continues to increase, transpiration rates will increase and amounts of water moving through the soil to the stream channels will decrease. Thinning dense upland stands could reduce transpiration rates and thus allow more water to reach the stream channels during the summer. Research is needed to determine the effect of density management on low flows. It is possible that the remaining trees would appropriate any excess water.

Surface water withdrawals first occurred for hydraulic mining in the 1860s and many of these water rights still exist. Irrigation diversions proliferated from the 1890s through the 1920s until many streams were overappropriated. Withdrawals for mining and irrigation continue to be the dominant uses and have a significant impact on low flows in the Middle Applegate Watershed.

Ground water withdrawals started to increase in the 1970s with the increase in population density. These withdrawals affect streamflows by removing water from the soil and preventing it from eventually reaching stream channels.

Water Quality

Beneficial water uses in the Middle Applegate Watershed are domestic water supply, municipal water supply, industrial water supply, irrigation, livestock watering, cold water fish, other aquatic life, wildlife, recreation, aesthetics, and power development (ODEQ 1992). Four streams in the Middle Applegate Watershed are identified in the 1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution (ODEQ 1988) as having impacted beneficial uses: Applegate River, Forest Creek, Thompson Creek, and Ninemile Creek. No streams are designated as water quality limited under the Clean Water Act.

Water quality problems in the Middle Applegate Watershed include elevated summer stream temperatures, turbidity/sedimentation, low dissolved oxygen, nutrients, low flows, and insufficient stream structure. The severity of nonpoint source pollution is greatest in Forest Creek.

Prior to Euro-American settlement, water quality was good in the Middle Applegate Watershed: low turbidity, low water temperatures, and acceptable chemical parameters (USDA and USDI 1995a). Soils in the watershed are predominately stable and not prone to landslides or surface erosion.

The arrival of Euro-Americans in the 1850s produced noticeable changes in water quality. Mining activities, especially large scale hydraulic mining, dramatically increased sediment in the Applegate River and its tributaries. Hydraulic mining is no longer allowed and placer mining requires the use of settling ponds. Consequently, the affects of mining on water quality are now considered minimal and are expected to remain low in the future.

Agricultural development in the valley bottoms began in the 1850s. Agricultural activities affecting water quality included clearing streamside vegetation, livestock grazing, and irrigation. Water quality impacts were increased turbidity/sedimentation, lower summer flows, lower dissolved oxygen, increased nutrients, higher stream temperatures, and reduction of stream structure. Affects on water quality from agricultural activities as well as residential development are still occurring and are expected to continue in the future.

Logging activities in the late nineteenth and early twentieth centuries were limited in scale and resulted in localized water quality impacts. During the late 1940s and throughout the 1950s logging steadily accelerated and expanded throughout the Middle Applegate Watershed. The transportation network associated with timber harvest greatly increased during the second half of the twentieth century. Large scale timber harvest and road building resulted in increased turbidity/sedimentation, higher stream temperatures, and reduced stream structure. Roads continue to be a major source of sediment in the Middle Applegate Watershed, although improved methods for design, location, construction, and maintenance have greatly reduced erosion from roads on federal lands. The trend toward watershed restoration, in particular road decommissioning and upgrading, is likely to further reduce road-caused sediment sources. Water quality impacts from timber harvest activities on federal lands are anticipated to decline with implementation of the Northwest Forest Plan and Riparian Reserves. Management of riparian areas on non-federal lands is expected to improve under the revised Oregon Forest Practices Act Water Protection Rules (Oregon Department of Forestry 1995).

Overall, watershed cumulative effects on water quantity and quality likely reached a peak between 1960 and 1980, and now appear to be in a downward trend due to hydrologic recovery, road decommissioning and upgrading, and improved stream protection.

A complete stream inventory is needed to identify all sensitive stream reaches, however several stream reaches appear to be unstable based on morphological classification. These include the lower reach of Ferris Gulch, lower reach of Slagle Creek, Humbug Creek (between Left Fork and Kane Creek), and Forest Creek (between Bishop Creek and the Right Fork). Hydraulic mining may have been a factor that caused these stream reaches to become unstable.

Riparian Vegetation and Habitat

Human influences on riparian habitat in the Middle Applegate Watershed began as early as the 1820's when Hudson Bay Company trappers extensively removed beavers from the watershed. Mining, logging, agricultural practices, road construction, and residential development have all influenced changes in natural processes and functions in riparian and wetland habitats.

Today the streams lack structure, complexity, and species diversity when compared with pre-1800 conditions (USDA and USDI 1994c). Streams have fewer pools, and remaining pools are more shallow. Tributary summer streamflows have decreased and are more prone to flashy runoff during winter storms. Since the Applegate Dam became operational, augmented summer flows and flood control have greatly helped water quantity and quality problems in the Applegate River, but the curtailing of normal flood events may impair flood related processes over time.

Riparian habitat has less diversity in plant species and structure than pre-1800 conditions (USDA and USDI 1994c). Himalayan blackberries have invaded most riparian zones at lower gradients. The current supply of large woody material is generally inadequate to meet the needs for nutrient cycling, habitat diversity and maintenance of diverse stream geomorphology. Agriculture, residential development, and roads have restricted normal flood plain processes. On an average, there are 12.4 miles of roads in each square mile of riparian habitat on fish-bearing streams in the watershed.

Nutrient cycling has been impaired by changes in upslope areas as well as in the riparian zone. Logging has reduced the present and future supply of coarse woody debris and streamside roads have interrupted the natural movement of materials and nutrients from upslope areas to the riparian zone. Consequently, natural functions and processes have been altered and simplified in all but a few headwater reaches of the watershed.

In 1991, the BLM Director approved the *Riparian-Wetland Initiative for the 1990's* (USDI 1991) which established goals and objectives for managing riparian-wetland resources on public lands. The initiative categorizes riparian-wetland habitats according to their ability to maintain natural processes and functions. These categories are proper functioning condition, functional-at-risk, and nonfunctional. Each category is defined in the Riparian and Fish Report (Haight 1995). On-the-ground surveys to determine riparian-wetland condition in the Middle Applegate Watershed are needed. However, sufficient information from general observations and aerial photographs was obtained to make tentative judgements. Map 19 displays riparian condition for fish-bearing streams in the watershed.

Under BLM's mandate of multiple-use management, a variety of activities such as livestock grazing, timber harvest, mineral extraction, recreation, and road construction takes place on public lands. The Aquatic Conservation Strategy in the Northwest Forest Plan (USDA and USDI 1994a) aims to ensure that land use activities restore and maintain aquatic ecosystems on public lands. The Aquatic Conservation Strategy establishes interim riparian reserve widths to accomplish these objectives. Watershed analysis, site-specific analysis, and appropriate NEPA compliance are required to change riparian reserve boundaries.

Fish

The alteration of riparian habitat, channel geomorphology, and water quality and quantity from prehistorical conditions combined with the introduction of exotic fish species have drastically reduced salmon, steelhead, and resident trout. Effects on native non-game fish and macroinvertebrate populations are unknown.

In the Applegate River, flow augmentation and flood control provided by the Applegate Dam have significantly improved historic conditions. There are definite gains in numbers of spawning fall chinook. Coho and winter steelhead are also likely to benefit from increased summer streamflows and lower summer stream temperatures.

In major tributaries, low, warm flows continue to impair steelhead and coho production. Sediment and frequent high levels of turbidity are also continuous problems to egg, fry and macroinvertebrate survival.

Other factors such as pre-spawning mortality due to disease and the effects of natural events such as El Nino on ocean survival of juveniles, have influenced anadromous fish run sizes. Commercial and sport fishing in the ocean and sport fishing in the Rogue River also remove adult fish from the gene pool, but the extent of the reduction in potential numbers of spawning fish returning to the Applegate River is unknown. It is important to recognize these causes and effects, however they are outside the scope of management activities in the Middle Applegate Watershed.

MANAGEMENT OBJECTIVES AND RECOMMENDATIONS

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
HUMAN DIMENSION			
Mining	Continue to coordinate with individuals, companies, county, state, and other federal agencies on all inquiries/applications for mineral exploration and development on BLM-managed lands.	1. Respond to all requests in a courteous and timely manner. 2. Accept and process all mining claims.	High High
	Rehabilitate areas disturbed due to past mining claim activity. On disturbed sites, ensure public safety and enhance other resource values such as riparian habitat or fisheries production.	1. Evaluate and prioritize known disturbed areas for rehabilitation. 2. Develop rehabilitation plans including work months and budget for targeted areas. Do this through an interdisciplinary effort. 3. Implement plans in a timely manner.	Low Low Low
Grazing	Manage livestock in a manner which maintains or improves Riparian Reserves in order to meet the goals of the Aquatic Conservation Strategy.	1. Stress the importance of properly functioning riparian areas in the issuance of grazing authorizations. 2. Implement Best Management Practices to ensure movement toward land use objectives.	High High
	Continue to provide livestock forage on designated allotments to meet societal needs, without compromising the ecological integrity of the uplands.	1. Develop management strategies in consultation with the permittee to resolve resource conflicts that arise. 2. Maintain a list of vacant allotments, including specific management constraints and concerns, for future inquiries.	High Medium
	Resolve unauthorized use complaints.	1. Inform private land owners of the importance of livestock control and provide technical assistance where necessary. 2. Continue to monitor historic problem areas.	Low Low

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Transportation	Manage a transportation system that serves the needs of the users and meets the needs identified under other resource programs.	1. Develop and maintain a road closure management plan. 2. Maintain all roads for the target vehicles and users. 3. Provide for initial fire suppression access. 4. Maintain a safe transportation system by removing hazards (eg. unstable trees) and providing transportation maps and roads signs. 5. Evaluate Transportation Management Objectives for individual roads. 6. Develop a Transportation Management Plan for the entire area.	High High High High Medium Medium
	Maintain a transportation system that meets the Aquatic Conservation Strategy and Riparian Reserve objectives.	Meet Aquatic Conservation Strategy and Riparian Reserve objectives by: • maintaining the transportation system to minimize sediment delivery to streams; • reconstructing, stabilizing, rerouting, closing, obliterating or decommissioning roads, skid roads, or landings that pose substantial risk to Riparian Reserves; • accommodating for 100 year runoff events when installing new stream crossing structures and for existing stream crossing structures that pose substantial risk to Riparian Reserves; • providing accommodations for fish passage at all potential fish bearing stream crossings and wherever possible maintain a natural stream bed; • following the Best Management Practices in the RMP; and • evaluating the condition of all roads in Riparian Reserves.	High High High High High High
Rights-of-way	Cooperate with individuals, companies, Jackson and Josephine counties, the state, and other federal agencies to achieve consistency in road location, design, use, and maintenance.	1. Maintain and implement reciprocal road right-of-way agreements. 2. Implement road use and maintenance agreements. 3. Evaluate and provide road right-of-way grants. 4. Obtain road easements for the public and resource management.	High High High Medium
	Continue to coordinate with individuals, companies, non-profit groups, counties, state, and other federal agencies on all inquiries/applications for non-road rights-of-way, leases, permits, and exchanges on BLM managed lands.	1. Respond to all requests in a courteous and timely manner. 2. Ensure consistency, fairness, and legal/environmental compliance in all decisions. 3. Review each request on its own merits.	High High High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Unauthorized Use	Minimize and/or reduce unauthorized use on BLM-administered lands.	1. Continue coordination with State/County agencies to ensure that resource needs on adjacent public lands are considered and accommodated in private actions. 2. Review and prioritize backlog cases and take steps to resolve in a timely manner.	High Low
Recreation	Work with OHV groups to jointly remedy problems, assist in project planning, and develop opportunities to prevent future problems.	1. Continue to encourage dispersed recreational opportunities by working with landowners to maintain access to these areas. 2. Work with local OHV users to rehabilitate eroding trails. Help monitor use and conflicts with area residents. 3. Develop Coop Agreement in an open forum with local OHV representatives to plan OHV use in the area consistent with land management objectives.	Medium Medium Low
Economic Development	Maintain and develop opportunities for special forest products to facilitate community economic development consistent with other resource objectives.	1. Work with groups like the Rogue Institute for Ecology and Economy to develop opportunities for the harvesting and sale of special forest products. 2. Encourage opportunities for local residents to compete effectively on contracts for projects in the watershed.	Medium Low
Public Involvement	Maintain contacts with local groups, adjacent landowners, community leaders, tribal and public agencies to facilitate continuing dialogue on the management of public lands in the Middle Applegate Watershed.	1. Continue to participate in Applegate Partnership activities. 2. Identify and incorporate tribal representation into all public involvement, and keep them informed on land management activities in the watershed. 3. Continue to encourage involvement of local interest groups such as the Applegate Watershed Conservancy, Thompson Residents for Ecological Education, the North Applegate Watershed Protection Association, and community leaders with land management practices and decisions. 4. Utilize the "Applegator" and Public Information Office in Ruch to keep the public appraised of land management activities occurring in the area.	High High Medium Low

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Archaeology	Assess archaeological sites to determine their scientific and heritage value and protect or recover those values as necessary.	1. Protect the site location of the re-buried Native American remains from any future disturbance (site 35AR11-150, in the vicinity of Forest Creek). 2. Define the types of historic and Native American archaeological sites which are likely to occur within the watershed. 3. Define the geographic areas where archaeological sites are likely to occur, through construction of an archaeological sensitivity map. 4. Classify known sites according to BLM manual cultural resource use categories, and manage accordingly.	High High Medium Low
TERRESTRIAL			
Soil	Maintain and enhance site productivity within natural ecological levels wherever operationally possible.	1. Locate areas of severe erosion with particular emphasis on steep, granitic Tallowbox and Rogue soils and steep, metamorphic Caris and Offenbacher soils. Plan and implement projects to stop unnatural erosion from occurring. Any new projects should always incorporate erosion control practices (Best Management Practices) where needed. 2. Maintain an amount and distribution of woody debris that will match healthy stand conditions. This will require surveys of various healthy stands to determine normal amount and distribution. Manage for recruitment and long-term maintenance of coarse woody debris (See Productivity in Terrestrial Vegetation section). 3. Reduce overall road densities. Give highest priority to drainage areas with road densities greater than four miles per square mile. Develop plan for decommissioning roads in those areas. 4. Maintain soil duff cover. 5. Maintain soil compaction levels as low as operationally possible. 6. Mitigate existing areas with high areal extent of compaction where feasible.	High High High Medium Medium Medium
Terrestrial Vegetation	The overall objective is to improve the structural characteristics and vigor of the vegetation in the watershed. Listed below are objectives for each vegetation condition class.		

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Pole, Mid, and Mature/Old-Growth Condition Classes	Increase tree growth, and quality and vigor of individual trees. (This objective is most critical to prevent the mortality of additional trees).	1. Treat timber stands with relative densities greater than 0.55 with the appropriate silvicultural prescription to reduce the number of trees per acre (or basal area) to a relative density of approximately 0.30 to 0.40. (Refer to Density Management Diagram for Douglas-fir in the Terrestrial Vegetation Report (Haupt, Moore, and Tong 1995) to visualize the concept of relative density and what any particular timber stand may look like at any point of stand development). 2. Use pruning as an option for improving wood quality in fast-growing pole stands.	High High
	Design and develop a diverse landscape pattern and contiguous areas of multi-layered, late-successional forest (timber stands with diversified stand structure in regard to tree height, age, diameter classes, and species composition). No less than 15 percent of the BLM forest lands would be in a mature/old-growth condition class at any time. The remainder of the forest lands would be in earlier stages of seral development.	1. Use the vegetation condition class map of the watershed to assure that recommended silvicultural prescriptions do not dissect contiguous areas of commercial forest stands. 2. Use group selection, single tree selection, irregular uneven-aged and intermediate cutting treatments (thinning and release) methods in combination or singly to create diversified stand structure of varying seral stage development.	High High
	Create large openings and suitable seedbeds to promote growth of pine species, incense cedar, and Douglas-fir. Increase the species composition of pine species and incense cedar in forest stands.	1. Use the group selection method to create openings of 0.25 to 1.5 acres. Approximately 5 to 20 percent of the commercial forestlands would receive the group selection method of harvest with a random pattern of group distribution across the landscape. 2. Create favorable seedbed conditions for ponderosa pine through prescribed burning or other methods that would eliminate the organic matter layer. Plant trees in the openings to ensure adequate stocking of pine species.	High High
	Assure survival of trees with old-growth characteristics by reducing vegetation competition in second growth timber stands.	Cut all trees that surround trees with old-growth characteristics to create an approximate 25-foot crown space between the old-growth tree and the remaining second growth trees. Cut only trees that are not associated (root or crowns entwined) with the old-growth tree.	High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Pole, Mid, and Mature/Old-Growth Condition Classes	Reduce the fire hazard of the timber stands by decreasing the ladder fuels while meeting the needs identified under other resource programs.	1. Decrease the ladder fuels in forest stands by slashing only dense patches of suppressed tree regeneration and shrub species, and the pruning of tree limbs. These treatments should eliminate fire fuels to a height of 6 to 12 feet above ground level. Cut tree limbs that extend into the pruning height area. 2. Form a mosaic of vegetative patterns by leaving untreated patches of vegetation scattered throughout the landscape.	High High
	Maintain the existing areas of knobcone pine to protect the ecological functions of the associated vegetation species.	Use prescribed burning in these stands to increase stocking levels of knobcone pine and to reduce plant competition from shrub species.	High
	In commercial forest stands that are scheduled for a regeneration harvest, maintain a minimum of 120 linear feet of logs per acre greater than or equal to 16 inches in diameter and 16 feet long in decay classes 1 and 2 (coarse woody debris). Leave woody debris to maintain site productivity and to aid the establishment of natural regeneration.	1. Perform surveys to determine average amounts of coarse woody debris over the landscape for the commercial timber land base and the respective vegetation classes. 2. Girdle and leave live trees standing or place cull logs where coarse woody debris is lacking. Leave cull, green trees to add a future debris source. Use a site-specific analysis to determine the amount of coarse woody debris to leave. (Timber stands that are commercially thinned should have coarse woody debris remaining but in lesser amounts and size).	High High
	Retain at least 15 percent of the federal land in the watershed as untreated area (in 0.5 to 2.5 acre blocks for 70 percent of the retained area).	Use landscape analysis and design to designate patches of untreated vegetation to remain in strategic locations (e.g., riparian reserves, critical habitat, wildlife corridors, areas between existing tree plantations, etc.).	High
Early and Seedling/Sapling Condition Class	Enhance structural diversity of even-aged, single layer canopy stands.	1. Enhance the structural diversity of these vegetation condition classes by precommercial thinning treatments at staggered intervals and favoring trees of different heights and species at the time of treatment. 2. Perform release treatments as needed.	Medium Medium

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Hardwood/ Woodland Condition Class	Maintain or improve the natural functions and processes of the native grass/oak woodlands plant associations where appropriate.	1. Manipulate vegetation species as necessary to maintain the natural functions and processes of the native grass/oak woodland plant associations. 2. Discourage high stocking densities of conifers by using manual and prescribed burning techniques. 3. Control the abundance of shrub and noxious weed species. 4. Reduce the density of hardwoods to increase water and nutrient availability to the hardwoods for mast production. 5. Use prescribed burning to accomplish these recommendations (#1-4). 6. Seed native grass species into areas of exposed, disturbed soil before noxious weeds become established.	High High High High High High
	Introduce a younger age class into the oak woodlands.	1. Cut suppressed and intermediate crown class trees to induce sprouting. Manage the sprout clumps to favor growth of the dominant sprouts. (After the vigor is restored to the oak trees, acorn crops should provide for more natural regeneration). 2. Plant oak trees where appropriate.	Medium Medium
Shrub Condition Class	Maintain the integrity of the shrublands.	1. Control tree species to maintain the dominance of the desired shrub species. 2. Control or eliminate noxious weeds.	Medium Medium
Grass Condition Class	Maintain the integrity of the native grasslands.	1. Treat tree and shrub species to maintain the dominance of native grasses. 2. Control or eliminate noxious weeds. 3. Seed native grasses on recently disturbed areas to prevent the establishment of noxious weeds. 4. Develop a native grass propagation program for native grasses found in the watershed.	Medium Medium Medium Medium

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Vascular and Nonvascular Plants	Preserve, protect, or restore species composition and ecological processes of natural plant communities.	1. Encourage native species use for projects such as native plant community restoration, erosion control, or wildlife forage. 2. Avoid the use of native species from non-local stocks which may be a threat to local genetic diversity. 3. Develop a sustainable and economical native seed source for future reseeding efforts. 4. Protect all known sites of Survey and Manage species until specific protocols and management policies are finalized. 5. Control noxious weeds and other exotic species. 6. Develop a strategy in cooperation with Oregon Department of Agriculture to inhibit the future spread and reduce and/or eliminate noxious weeds.	High High High High Medium Medium
	Conserve and enhance rare and special habitats, endemic plant communities, and ecosystems.	1. Retain patches of late-successional or old growth forest. These patches are beneficial to species that are poor dispersers, narrow in their habitat requirements, have restricted geographic ranges, and are sensitive to variation in microclimates. 2. Maintain habitat for lichens, fungi, and bryophytes which includes live, old-growth trees, decaying wood, and riparian zones.	High Medium
	Avoid management actions that will contribute to the need to list any species as Threatened or Endangered by either the state or federal agencies.	Develop management plans for special status species.	High
Noxious Weeds	Control and/or reduce noxious weeds within the watershed.	1. Reseed areas with a native or non-persistent non-native mixture following ground disturbance to prevent invasion by weed species. 2. Locate and map noxious weed populations within the watershed.	High Medium

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Fire and Air	Reduce the risk of loss from and the occurrence of catastrophic wildfire while meeting the needs identified under other resource programs.	1. Construct shaded fuel breaks along main ridges and high value areas (e.g., rural interface areas) where they can be maintained efficiently in the future. This pre-attack wildfire planning creates defensible areas for suppression. 2. Remove ladder fuels and any lower canopies in canyons. Canyons are normally areas which contain intermittent streams. These areas create chimneys during wildfire events and increase the probability of catastrophic events. 3. Maintain or improve the current initial attack system for suppressing wildfire (e.g., fire lookout towers, installation of beacons for the Automated Lightning Detection System).	High High High
	Lower the high hazard areas (where possible) to a medium hazard while meeting the needs identified under other resource programs.	1. For high fire hazard with high fire risk areas, thin and prune the vegetative profile (where appropriate). All unused material should be removed, chipped, piled, and/or prescribe burned. 2. For high fire hazard with moderate fire risk areas, thin and prune portions (40-60 percent) of the landscape (where appropriate). All unused material should be removed, chipped, piled, and/or prescribe burned. 3. Prescribe burn (where appropriate) brushfields and plant native grasses.	High Medium Medium
	Lower the medium hazard areas (where possible) to a low hazard while meeting the needs identified under other resource programs.	1. For medium fire hazard with high fire risk areas, thin and prune the vegetative profile (where appropriate). All unused material should be removed, chipped, piled, and/or prescribe burned. 2. For medium fire hazard with moderate fire risk areas, thin and prune portions (40-60 percent) of the landscape (where appropriate). All unused material should be removed, chipped, piled, and/or prescribe burned.	Medium Medium
	Reduce the human ignition sources causing wildfire.	1. Coordinate and work closer with private landowner, Fire District #9, Oregon Department of Forestry, and U.S. Forest Service to educate people who are not familiar with the wildfire potential in the Applegate (i.e., new residents, out-of-area workers, etc.). 2. Limit road access in high risk/high hazard areas during periods of elevated fire danger.	High High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Fire and Air	Enhance and restore fire resistant trees.	1. Remove all vegetation around pine, oak, large Douglas-fir, and large cedar trees where appropriate. 2. Plant pine and oak trees where appropriate.	Medium Medium
	Maintain and enhance air quality.	For all unused material, favor hazard reduction in the following order: removal, chipping or lop and scatter, and prescribe burn (e.g., pile and burn, underburn).	High
Terrestrial Wildlife	Maintain or enhance populations of the terrestrial wildlife species found in the watershed.	1. Develop and maintain an appropriate amount and distribution of the seral stages of all plant communities in the watershed. 2. Maintain adequate snags and coarse down woody debris to accommodate those species that are dependent upon these habitat features. 3. Identify and protect special habitats such as mines/caves, talus, and grassland.	High High High
	Provide Protection Buffers as outlined in the ROD for the Northwest Forest Plan.	1. Great Gray Owl - protect nest sites and meadows greater than 10 acres in size with buffers of ¼ mile and 300 feet, respectively. 2. Siskiyou Mountain Salamander - provide a horizontal buffer of at least 100 feet or 1 site potential tree around the periphery of known sites. 3. Bats - provide 250 foot buffers around caves, mine adits and shafts, wooden bridges, and old buildings where any of the following species are found: fringed myotis, silver-haired bat, long-eared myotis, long-legged myotis, pallid bat, and Townsend's big-eared bat.	High High High
	Maintain timbered dispersal corridors on the south and west facing slopes of the watershed.	Protect these dispersal corridors from catastrophic events to the extent reasonably possible.	High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
AQUATIC			
Water Quantity	Maintain and enhance in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. Protect the timing, magnitude, duration, and spatial distribution of peak, high, and low flows.	1. Thin dense upland stands to reduce water losses due to interception and transpiration.	High
		2. Reduce upland fire hazard to minimize potential for catastrophic wildfires.	High
		3. Reduce soil compaction by decommissioning or obliterating roads and ripping skid trails.	High
		4. Discourage spring development or surface/ground water diversions on BLM-administered lands if the development or diversion would not meet the Aquatic Conservation Strategy Objectives.	High
		5. Evaluate existing BLM water developments to determine if they are needed and eliminate unneeded developments.	High
		6. Manage the transient snow zone for dense canopy closure where it doesn't conflict with other resource objectives.	Medium
		7. Work with Applegate River Watershed Council, other community members, and agencies to identify opportunities in the watershed to increase low flows.	Medium
		8. Work with Oregon Water Resources Department to increase in-stream flow water rights.	Medium
		9. Study feasibility of constructing small reservoirs in upper reaches of Middle Applegate tributaries for augmentation of summer flows.	Low

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Water Quality	Maintain and enhance water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Reducing summer stream temperatures and sedimentation are two principal water quality objectives in the Middle Applegate Watershed.	1. Reduce road density, with special emphasis on Forest Creek and Spencer/Rock subwatersheds.	High
		2. Obliterate, decommission, or upgrade roads as necessary to reduce sedimentation and meet transportation management objectives. Highest priorities for road treatments are roads contributing large amounts of sediment to streams, and roads in riparian reserves, unstable areas, and midslopes.	High
		3. Plan and implement projects to reduce erosion from off-highway vehicle use.	High
		4. Plant or maintain native species in riparian areas and wetlands to provide adequate stream shading.	High
		5. Stabilize eroding stream banks.	High
		6. Maintain or enhance channel structure to provide energy dissipation.	High
		7. Apply Best Management Practices identified in the Resource Management Plan to minimize soil erosion and water quality degradation during management activities.	High
		8. Reduce stream width-to-depth ratios where appropriate.	Medium
		9. Coordinate with the Applegate River Watershed Council, other community members, and agencies to improve water quality.	Medium

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Riparian Reserves	Maintain and enhance the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability. Maintain and enhance riparian habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.	1. Use interim Riparian Reserve widths identified in the ROD Standards and Guidelines (pages C-30 and 31) until a project level, site-specific analysis is performed by an interdisciplinary team.	High
		2. Use an interdisciplinary process to design site-specific Riparian Reserve treatments that promote the following conditions.	
		• Species and structural diversity of plant communities.	High
		• Late-successional characteristics along fish-bearing streams.	High
		• Stand age diversity along nonfish-bearing streams.	High
		• Microclimate requirements of associated plants and animals.	High
		• Dispersal habitat for terrestrial species in west and south facing coniferous corridors.	High
		• Adequate cover for terrestrial wildlife.	High
		• Adequate nesting and foraging habitat for terrestrial species.	High
		• A minimum of 80 percent of site potential shading for perennial streams.	High
		• Adequate amounts of coarse woody material.	High
		• Adequate nutrient cycling.	High
		3. Consider implementing the following treatments in Riparian Reserves as appropriate.	
		• Plant conifers and/or other appropriate native species.	High
		• Reduce density in overstocked stands.	High
		• Reduce fuel ladders.	High
		• Reroute, obliterate, and/or rehabilitate roads, skid trails, and landings.	High
		• Identify individual trees with stream recruitment potential and manage them for late-successional characteristics.	Medium
		• Place coarse wood in stream (where appropriate) as a short term solution.	Medium
		• Fall hazard trees across streams.	Medium
Fish	Manage habitat for all species of anadromous, resident trout, and native non-game fish on BLM-administered lands.	1. Work with other agencies and private groups to protect and improve stream habitat.	High
		2. Correct known artificial barriers to fish.	High
		3. Update and refine GIS fish distribution data.	Low

LANDSCAPE ANALYSIS AND DESIGN

Realizing that the landscape of the Middle Applegate Watershed is a complex web of interacting ecosystems, the watershed analysis team melded individual resource information into an interpretation of the landscape. The team looked at the current condition of the terrestrial and aquatic components of the landscape and synthesized the information to develop landscape pattern objectives and recommendations (Table 16). Map 20 illustrates the synthesized resource data: commercial forest stands with late-successional characteristics; three areas of late-successional forest stands that are in need of connectivity; areas where late-successional forests should be developed; south/west aspect wildlife dispersal corridors; areas where wildlife corridors between watersheds should be maintained; strategically positioned shaded fuel breaks; the transient snow zone; steep granitic soils; and Late-Successional Reserve land use allocation area. Riparian Reserve locations will be added to the map after water body categories (i.e., streams and wetlands) are identified on-the-ground.

Table 16. Landscape Pattern Objectives and Recommendations

Objectives	Recommendations
Design and develop connectivity between and within the Rock Gulch, Chapman-Keeler Creek, and Thompson Creek late-successional areas on BLM lands.	Assure that recommended silvicultural prescriptions create late-successional characteristics between the three respective areas. Sections 2 and 3 of Township 39 South, Range 4 West are critical for connecting the Thompson Creek and the Chapman-Keeler Creek late-successional areas. Sections 5, 6, 7, and 32 of Township 39 South, Range 3 West are critical for connecting the Chapman-Keeler Creek and the Rock Gulch late-successional areas.
Develop commercial forest stands with late-successional characteristics within the Slagle Creek/Humbug Creek/Balls Creek area, and the Bishop Creek/Squires Peak area. Late-successional stands should also be created between drainage areas.	1. Assure that recommended silvicultural prescriptions maintain contiguous areas of late-successional forest. 2. Use a variety of silvicultural methods to create the desired characteristics for late-successional forests within these areas.
Retain critical, forested wildlife corridors on drainages with south/west aspects.	1. Designate six drainages as important wildlife corridors (Slagle Creek, forks of Humbug Creek, forks of Balls Creek, and Long Gulch). 2. Manage the adjacent landscape to protect corridors from natural disturbances (i.e., fire, wind, etc.). 3. Treat all vegetation condition classes surrounding the corridors to reduce the fire hazard rating, thus protecting the timber stands.

Objectives	Recommendations
Retain or create wildlife corridors between the Middle Applegate and surrounding watersheds.	1. Designate two key wildlife migration corridors: one in Sections 27 and 33, Township 37 South, Range 4 West; and the other in Sections 9, 10, 11, 12, and 16, Township 39 South, Range 4 West near Tallowbox Lookout. 2. Use appropriate silvicultural prescriptions to maintain forested timber stands within and between adjacent watersheds.
Treat all vegetation condition classes in strategic locations, especially commercial forest stands, to ensure their survival from insects and fire, and enhance seral and structural development of the condition classes.	1. Develop prescriptions that reduce fire hazard and improve vegetation health to protect natural resources or sites of cultural value from biotic disturbances (fire and wind). 2. Manage vegetation density of all vegetation condition classes to accomplish this objective. Areas needing vegetation management (density management) include Thompson Creek, Slagle Creek/Humbug Creek/Balls Creek, and Bishop Creek/Squires Peak. 3. Use selection silvicultural harvest methods to create or enhance the development of late-successional forests.

Objectives and recommendations for managing shaded fuel breaks, steep granitic soil areas, the transient snow zone, and Riparian Reserves are discussed in the Management Objectives and Recommendations section of this document.

DATA GAPS, MONITORING, AND RESEARCH

Items under each ecosystem element are listed in priority order.

DATA GAPS

Human Dimension

Mining

1. Locations of areas disturbed due to past mining activity.

Grazing

1. Rangeland trend/condition assessment, primarily for allotments within the Improve (I) category (Moore 1995).
2. Potential cooperative livestock related projects on private lands within the watershed.
3. Economic contribution of livestock operations to local communities.

Transportation

1. Road condition surveys.
2. Updated road closure inventory.
3. Transportation management plan.
4. Updated transportation management objectives.
5. Updated maintenance operation plan.

Unauthorized Use

1. Property lines in the designated rural interface areas.
2. Property lines in locations where unauthorized use is suspected.

Archaeological Sites

1. Systematic archaeological survey.
2. Formal evaluation of known historic sites.

Terrestrial Components

Soils

1. Inventory of road-induced erosion problems.

2. Comprehensive data on percent duff cover and thickness.
3. Comprehensive data on coarse woody debris size and distribution throughout the watershed.
4. Inventory of areas used by Off-Highway Vehicles (OHV).
5. GIS soils information for Josephine County lands on the western edge of the watershed and Forest Service lands at the head of Thompson Creek.
6. Specific relationships between duff/woody material and beneficial soil organisms in the Middle Applegate.
7. Areas with high soil compaction.
8. Extent of lag slopes.
9. Locations and extent of highly eroded or steep raveling areas, aggraded stream reaches, and high elevation, old, non-reforested clearcuts.
10. Site specific studies concerning natural erosional processes.
11. Extent of northeasterly trending bands within the Applegate Formation.

Terrestrial Vegetation

1. Comprehensive data on drought resistance for tree and shrub species.
2. Soil carbon/nitrogen ratios.
3. Available trace elements in the soil and trace element requirements of tree species.
4. Comprehensive studies on the ecological requirements of Oregon white and California black oak to produce acorn crops, including optimum tree density (stems/acre), impact of competing vegetation (how much can grow around the oaks?), and the occurrence, frequency, and intensity of fires needed to return nutrients to the soil.
5. More statistical data regarding the historical range, frequency, and distribution of vegetation species over the landscape.

<u>Vascular and Nonvascular Plants</u>

1. Role of fungal species, bryophytes, and lichens in the ecosystem.
2. Inventory of special status plants.
3. Inventory of non-native plant species (especially noxious weeds).
4. Historical population data on special status plants (includes range, distribution, and frequency).

Fire and Air

1. Exact acreage and location of existing and past high hazard, medium hazard, and low hazard areas.
2. Data regarding the range, frequency, distribution, and interaction of insects, animals, vegetation and fire intensities.
3. Wildfire intensities and consumption rates over the landscape during differing climatic conditions through time.
4. Cultural understanding of fire use during prehistoric times.
5. Complete fire start information (e.g. location, cause, time) prior to 1969.
6. Classification of land by plant association within and outside fire regimes.

Wildlife

1. Existing and desired abundance and patch size distribution of the condition classes found in the watershed.
2. Occurrence, distribution and population data for those species found in the watershed.
3. Snag and coarse woody debris abundance by condition class.

Aquatic Components

Water Quantity and Quality

1. Sediment source locations (roads, OHV areas, etc.).
2. Stream categories on nonfish-bearing streams (permanently flowing or intermittent).
3. Field verification of Rosgen's (1994) stream classifications.
4. Stream channel stability/condition.
5. Streamflows for tributary streams.
6. Water quality data (turbidity, sediment, dissolved oxygen, nutrients, temperature) throughout the watershed.
7. Vegetation condition classes on private land.
8. Acres of soil compaction by subwatershed.
9. On-the-ground wetland inventory.

Riparian

1. Riparian condition.
2. Riparian and in-stream surveys to determine:
   a. amount of coarse woody debris
   b. amount, diversity and age of riparian vegetation, including percent of shading
   c. stream geomorphology, including pool/riffle ratios, pool depth, substrate composition, etc.

Fish

1. Inventory of aquatic insects.
2. Upstream distribution and relative abundance of all native fish species.
3. Spawning escapement of coho and steelhead.
4. Habitat requirements of non-salmonid native fish species.
5. Impacts of introduced fish on native species.
6. Distribution and relative abundance of non-salmonid species.
7. Number of Applegate River-produced anadromous fish harvested in the ocean and Rogue River.

MONITORING

Human Dimension

Mining

1. Monitor all mining claim activities on-the-ground for compliance with the regulations.

Grazing

1. Develop a rangeland studies program to monitor movement towards land use objectives and desired rangeland conditions.

Terrestrial Components

Soils

1. Monitor erosion features resulting from road construction.
2. Monitor effects of OHV use in problem areas.
3. Monitor gravel surface movement on steep slopes.
4. Monitor newly compacted areas through contract administration.

Terrestrial Vegetation

1. Monitor commercial timber stands for vigor by using relative density as an index.
2. Measure individual tree growth in commercial timber stands.
3. Analyze crown closure/canopy closure before and after vegetation treatment.
4. Monitor forest health by using green spectral analysis (Items 3 and 4 can be monitored by using low elevation, VHS photography).
5. Monitor amounts of coarse woody debris before and after timber harvesting operations.
6. Monitor the number and quality of snags (and perhaps how the trees were killed; insects or pathogens) and suitability of cavity formation.

<u>Vascular and Nonvascular Plants</u>

1. Monitor plant population's response to disturbance.
2. Monitor environmental effects on special status plants.

Fire and Air

1. Monitor changes in hazard ratings after all the vegetation condition classes have been treated.

Wildlife

1. Monitor site occupancy, reproductive status and reproductive success of threatened/endangered species found in the watershed.
2. Monitor population trend of the special status and other priority species found in the watershed.
3. Monitor rate of recruitment/loss of snags and coarse woody debris.
4. Monitor rate of seral stage change in the vegetative communities found in the watershed.

Aquatic Components

Water Quantity and Quality

1. Monitor changes in road density and condition.
2. Continue monitoring stream temperatures and increase number of monitoring sites.
3. Measure streamflows in tributaries using non-recording stream gages and correlate with Star Gulch flows.
4. Monitor dissolved oxygen and nutrients at temperature sites.
5. Monitor turbidity levels in selected tributaries.

Riparian

1. Monitor riparian habitat (i.e., coarse woody debris, shading, microclimate, etc.) before and after implementing management prescriptions.

Fish

1. Monitor summer steelhead spawning activity in Ninemile Creek.
2. Continue to monitor selected sites on Thompson and Forest Creeks for macroinvertebrates.
3. Request that Oregon Department of Fish and Wildlife monitor Coho spawning in Applegate River and lower Thompson Creek.
4. Monitor non-salmonid native fish populations and introduced fish populations.
5. Monitor fish habitat.

RESEARCH

Terrestrial Components

Soils

1. Determine comprehensive data on percent duff (cover and thickness), coarse woody debris (size and distribution) and relationships to beneficial soil organisms in the watershed.

2. Study natural erosional processes versus human aggravated erosional problems to determine extent of site productivity loss.
3. Obtain more comprehensive mapping data on bedrock geology and associated field studies.

Terrestrial Vegetation

1. Determine the evapotranspiration rates for all endemic tree and shrub species (in inches of water).
2. Determine how many old-growth trees are needed on a per acre basis to maintain ecosystem functions of late-successional forests.
3. Determine what the coarse woody debris requirements of the watershed are to maintain site productivity.
4. Determine stocking levels of oak species that are optimum for producing acorn crops (The amount of nutrient inputs into the oak woodlands induced by prescribed burning may also be critical).
5. Develop methods of controlling noxious weeds.

Vascular and Nonvascular Plants

1. Obtain population biology data (includes information on life history, life cycle, limiting factors, seed dispersal and seed dispersal corridors, pollinators, dormancy, recruitment, seed bank, interaction between and within species, mortality, predation, pathogens, and genetic diversity).
2. Determine ecological requirements (includes species composition changes over time and under different successional stages, relationships among species, associations, affects of biotic and abiotic factors, distance and effectiveness of dispersal, specific habitat requirements, nutrient dynamics, food chains, diversity between populations, etc.).
3. Determine more about fungal species/communities and how they relate to ecosystem functions and health.
4. Determine demographic data (includes population structure, number, size, reproductive condition, distribution, and trend).

Wildlife

1. Use the MAXMIN approach, as described by Raphael (1991), to determine the optimum mix of age classes/seral stages of the vegetative communities found in the watershed to maximize the probability of viability of all indigenous species.

Aquatic Components

Water Quantity and Quality

1. Study the effects of forested stands of differing densities in different soil types on streamflows and water quality.
2. Determine the change in streamflows resulting from density management treatments.

Fish

1. Request that ODFW research the impacts of introduced fish on resident fish populations in the Applegate River.
2. Determine impact of flow alteration from the Applegate Dam and water withdrawals on native fish habitat.

LIST OF PREPARERS

Responsibility	Team Member
Team Leader, Hydrology	Laurie Lindell
Facilitator	Jim McConnell
Geographical Information System (GIS)	Bob Pierle
Air, Fire, and Logging	Bill Yocum
Fish and Riparian	Bill Haight
Geology	Dennis Glover
Geomorphology and Soils	Dave Maurer
Grazing	Bill Moore
Human Dimension and Public Involvement	Layne Lange
Lands and Mining	Joe Hoppe
Plants	Brad Tong
Transportation	John Samuelson
Vegetation	Scott Haupt
Wildlife	George Arnold and Vicki Arthur

The following individuals were not on the team, however, they contributed their valuable technical expertise to the watershed analysis.

Kate Winthrop - Archaeology
David Squyres - Hydrologic data, cover photo
Jeannine Rossa - Editor, channel morphology classification

LIST OF TECHNICAL REPORTS

Following is a list of unpublished technical reports used in the preparation of this watershed analysis. These reports were written by the watershed analysis team and are available upon request from the Medford District Office, Ashland Resource Area.

Human Dimension

Agriculture Report, prepared by Bill Moore.
Archaeology Report, prepared by Kate Winthrop.

Terrestrial

Wildland Fire Hazard in the Applegate Interface, prepared by Bill Yocum.
Geology, Geomorphology, and Soils Report, prepared by Dennis Glover and Dave Maurer
Terrestrial Vegetation Report, prepared by Scott Haupt, Bill Moore, and Brad Tong
Wildlife Report, prepared by George Arnold.

Aquatic

Hydrology Report (includes Climate), prepared by Laurie Lindell.
Riparian and Fish Report, prepared by Bill Haight.

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APPENDIX A
PUBLIC INVOLVEMENT PLAN

Public participation for the Middle Applegate Watershed Analysis will build upon analysis and public participation efforts that have already occurred in the Applegate Management Area. Issues, concerns and watershed conditions developed through the preparation of the *Little Applegate River Watershed Analysis* and the *Words into Action: A Community Assessment of the Applegate Valley*, along with the information contained in the *Applegate Adaptive Management Area Ecosystem Health Assessment* and its addendum, *Aquatic, Wildlife and Special Plant Habitat* were used as a basis for developing the issues and concerns for the Middle Applegate Watershed Analysis.

The issues and concerns specific to the Middle Applegate will build upon this foundation in a number of ways. At the beginning of document preparation, personal contact will be made with interest groups in the area. This initial contact will be to inform them of BLM's intent to prepare a watershed analysis, identify preliminary issues and concerns, and ask them to contribute thoughts and ideas. Groups to be included in this initial contact are:

Applegate Partnership
Applegate Watershed Conservancy
Hangglider contacts
Headwaters
Issac Walton League
Jackson County Stockmen's Association
North Applegate Watershed Protection Association
Northwest Steelheaders
Off-Highway Vehicle group
Oregon Hunters Association
Rogue Flyfishers
Sierra Club
Southern Oregon Timber Industry Association
Thompson Residents for Ecological Education

Recognizing that contacting these groups will not reach a large segment of those involved and interested in proposals for the Middle Applegate area, informational posters will also be prepared and posted at key meeting places throughout the area including the Information Center in Ruch. These posters will also explain BLM's intent to prepare a watershed analysis and ask for public input.

Early in the process, the team will host an Open House at a location and time convenient to local residents and public agency representatives. The Open House will be a forum for information exchange. Preliminary issues and key questions will be displayed and attendees will be given the opportunity to share their ideas and concerns with the team. Prior to the Open House an extensive mailing list will be developed. The list will include local residents as well as group and agency representatives that may be interested in proposals for the Middle Applegate. Notification of the Open House will be sent to individuals and groups on this list. The mailer will also ask for a written response if they are unable to attend the meeting. The Open House will also be advertised on flyers posted at key meeting locations in the area and at the Information Center in Ruch.

Information received from initial contacts, the Open House, and mailers returned will be incorporated in the document. As the watershed analysis document is developed, interested individuals and groups will be kept appraised of the progress and findings.

Upon completion of the first iteration, people on the mailing list will be notified of the availability of the Middle Applegate Watershed Analysis. They will have an opportunity to request an executive summary, the watershed analysis, and/or technical reports. Those requesting the executive summary or full document will be included on a mailing list for future updates as they occur.